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Abstracts of the ASHS Southern Region 71st Annual Meeting Corpus Christi, Texas 5–7 February 2011

Norman F. Childers MS Graduate Student Paper Competition

Orchard Design Influences Satsuma Mandarin Production

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Freeze protection is the most challenging aspect of commercial satsuma mandarin production in Alabama. Growers have used various orchard designs to reduce freeze damage for decades, as well as using other methods. These designs include interplanting between pecan and pine trees, planting in open fields with microsprinkler irrigation, and planting behind windbreaks. The goal of this research was to determine the effects of different orchard designs on orchard temperature, photosynthesis, light interception, fruit quality, and specific leaf area. The pine tree canopies buffer freezing temperatures when compared to the other designs. However, the shade leads to a significant reduction in photosynthesis and light interception. Specific leaf area is higher in orchards interplanted between pines. The significant reduction of light under pine tree canopies reduces fruit quality as well as yield. The orchards with high light interception contribute to higher fruit quality and photosynthesis. However, these orchards do not buffer freezing temperatures and will require other methods of protection to prevent damage due to critically low temperatures.

Influence of Induced Polyploidy on Fertility and Morphology of *Rudbeckia* Species and Hybrids

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Rudbeckia spp. are adaptable and valuable ornamental wildflowers. Development of new varieties of *Rudbeckia* spp., with improved commercial characteristics, would be highly desirable. Interspecific hybridization and induced polyploidy may be avenues for improvement within the genus. The objective of this study was to evaluate fertility, morphology, and phenology of flowering for multiple lines of induced allopolyploids of *R.*

subtomentosa × *hirta* and autopolyploids of *R. subtomentosa* ‘Henry Eilers’. Isogenic polyploid lines were developed in vitro using oryzalin as a chromosome doubling agent. Plants were grown outside in a randomized complete-block design with 12 replications. To evaluate male fertility, pollen was stained with a 1% acetocarmine solution and scored for viability. Compared with their diploid counterparts, autopolyploids of *R. subtomentosa* ‘Henry Eilers’ had similar internode lengths, plant heights, number of stems, and flowering times (date at first anthesis); reduced number of inflorescences and pollen viability; and increased inflorescence diameters. Compared with the diploid counterparts, allopolyploids of *R. subtomentosa* × *hirta* had similar internode lengths; reduced number of inflorescences and delayed flowering times; and increased pollen viability. Plant height decreased with induced allopolyploidy in two hybrid isogenic lines while there was no significant effect on plant height of a third isogenic line. The number of stems decreased for two allopolyploid hybrid isogenic lines, but there was no effect on the other hybrid isogenic line. Female fertility is currently being evaluated.

Effects of Organic Fertilizers on *Chrysanthemum nankingense*

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Organic fertilizers are a source of all necessary macro- and micronutrients in available forms to improve both the physical and the biological properties of the soil. Nutrients contained in organic fertilizers are released more slowly in the soil, ensuring a long residual effect, supporting better root development, and leading to potentially higher crop yields. In this study, the effects of organic fertilizers were studied on greenhouse-grown *Chrysanthemum nankingense*. Mum cuttings were potted in 6-inch pots on 12 July 2010 and then pruned back to 5 cm above the pot rim on 13 July 2010. The inorganic fertilizers used in this study included slow-release fertilizer (SRF) Osmocote 13N–5P–10K (13–13–13) and liquid feed Peter’s 20N–4K–16K (20–10–20) at 150 ppm and 300 ppm application rates. The organic fertilizers used in this study included SRF Bradfield Bone Meal 9N–3P–0.8K (9–7–1), Nature Safe 10N–0P–0K (10–0–0), and liquid feed MegaGreen 2N–1.2P–0.8K (2–3–1) at 0.4 g nitrogen/pot and 0.8 g nitrogen/pot. Weekly 100 mL Wormwise (vermicompost tea) was used in combination with both organic and inorganic fertilizers. Plants were arranged in a randomized complete-block design with 6 replications. Plant growth index (GI) and SPAD reading were recorded at 17 d after planting (DAP), 35 and 49 DAP. Plants were harvested 49 d after transplanting. Fresh

*presenting author.

weights (FW) and dry weights (DW) were measured. Data were analyzed by Duncan's test at 5% confidence level. Results showed that the effects of slow-release organic fertilizers on plant growth were comparable with inorganic fertilizers on GI and SPAD when applied at the same rate. The effects of fertigation with organic fertilizers on plant growth were comparable with inorganic fertilizers on GI, SPAD, FW, and DW when applied at the same rate. Plants treated with 100 mL Wormwise weekly did not grow as well as plants without it.

Warren S. Barham PhD Graduate Student Paper Competition

Enhancing Plant Tolerance to Drought through the Use of Pageant

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Pageant (pyraclostrobin + boscalid) was applied as a foliar spray to evaluate its physiological benefits on *Impatiens walleriana* Super Elfin XP White under water stress. Two separate experiments were conducted to determine if weekly applications of Pageant enhanced water use efficiency in water-stressed impatiens. In Expt. 1, Pageant was applied at four different rates based on the recommended label rate: 0, 0.5× (0.114 g·L⁻¹), 1.0× (0.228 g·L⁻¹), and 1.5× (0.342 g·L⁻¹). In addition, three moisture levels were maintained based on substrate volumetric water content (VWC): 85% (well-watered), 55%, or 25% moisture. To determine VWC, a soil moisture curve was created based on the relationship between the soil moisture meter readings and actual VWC. Expt. 2 was similar to Expt. 1 except the three moisture treatments were based on 0, 3, or 6 d between watering. On days of watering, water applied was determined by 85% VWC. In both experiments, substrate VWC, shoot and root dry weights, and growth indices were measured. Results from Expt. 1 showed a moisture × rate effect in well-watered impatiens after weekly application of Pageant. Shoot dry weights were statistically greater with application of 1.0× Pageant compared to all other treatments. However, the relationship between shoot dry weight and rate of Pageant was quadratic. Expt. 2 showed no moisture × rate effects. Based on results from Expt. 1, Pageant applied at recommended label rate (1.0×) to well-watered impatiens can enhance shoot growth, respectively. However, Pageant applied to water-stressed impatiens did not enhance shoot growth.

An Assessment of Texas AgriLife Extension Agents' Need for Information on Organic Agriculture

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The purpose of this study was to describe the level of interest Texas AgriLife Extension agents are receiving from its clientele for information on organic agriculture and to describe their level of interest in training on organic agriculture. Primary variables of interest included level of interest in organic agriculture in their respective counties, previous training received, interest in future training, attitude towards organic agriculture, and Texas Extension's role and involvement in organic agriculture. A random sample of agents was selected (n = 151) and a response rate of 81.5% was achieved. A majority of agents indicated interest in organic agriculture in their respective counties had increased over the past 5 years (n = 60), but noted demand was still low (n = 39) to moderate (n = 42). Agents from urban or suburban counties reported higher levels of interest in organic agriculture than did agents from rural counties. Agents were most interested in training on organic soil fertility, insect, weed, and disease management and least interested in training on organic certification and transitioning to organic agriculture. Agents indicated traditional information resources would be the most useful delivery methods for communicating information about organic farming, which included print publications, a website with organic information and extension workshops. Agents' attitudes towards organic agriculture and their perceptions of Extension's role and involvement in organic agriculture were measured using attitudinal statements using a five-point summated scale with reliabilities of 0.76 and 0.76, respectively. It was found that agents neither agreed nor disagreed with statements affirming the viability of organic agriculture (M = 2.80) and statements advocating Extension's involvement in organic agriculture (M = 3.38). A stepwise multiple regression was run on the primary variables of interest to determine which variables predicted agents' interest in training, and found perception of Texas extension's capabilities and role, perception of organic agriculture, and current level of interest in their county accounted for over 50% of the variability.

Anthocyanins, Phenolics, and Antioxidant Capacity of *Vaccinium L.* in Texas

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Berries and leaves of *Vaccinium* have been an important source of food and pharmaceutical ingredients and harbor high levels of antioxidants. Blueberries in Texas are a substantial industry but there is no report on their antioxidant capacity, total phenolics, and anthocyanins. The objective of this study is to provide quality markers for both selection of cultivars and storage method and development of pharmaceutical products of *Vaccinium* in Texas with the highest antioxidant activity and nutritional level for domestic and overseas markets. The study evaluated antioxidant capacity, total phenolics, and anthocyanin contents in both fruits and leaves of major commercial cultivars including five species, five cultivars, and 11 selections grown in Nacogdoches, TX. Considerable variation in ferric reducing antioxidant power (FRAP), total phenolics, and anthocyanin content in fruits was observed among different genotypes with fewer variations among individual plants of the same genotypes. Our data of rabbiteye blueberry (*V. ashei*) supported the hypothesis that antioxidant capacity was more highly correlated to total phenolics rather than anthocyanins. Our analysis of five species/cultivars showed that antioxidant activity of fruits decreased during ripening but total phenolics contents tended to increase with maturity. Antioxidant capacity, total phenolics, and anthocyanin contents of berries had no significant changes in storage at 4 °C or freezing for 2 weeks but significantly decreased when oven dried at 65 °C for 48 h or longer. Antioxidant capacity and total phenolics content in leaves of each test genotypes were significantly (3–15 times) higher than those in fruits of the same genotypes.

Education Section

Feedback and Evaluation of Service Learning Projects in Horticulture

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Integration of service-learning experiences into a traditional lecture-based course requires a rethinking of methods for student evaluation. Over a period of 5 years, an upper-level course in landscape construction was converted from a classroom format to a field-based service-learning course. Students went from listening to lectures, participating in class discussions, completing homework assignments, and taking tests, to engaging in hands-on construction projects for the benefit of local non-profits. This change posed several problems, most notably, developing a fair and plausible means of evaluating students' progress achieving the learning goals and objectives of the course. With planned projects and activities it is clearly possible to advance students up the levels of Bloom's Taxonomy—cognitive, affective, and psychomotor. The problem comes in establishing a basis for

performance (grades) in an A–F course. This was accomplished by using traditional evaluation methods such as attendance, homework, and small drafting exercises, complemented by weekly journaling, peer evaluations, and project documentation through student portfolios. Weekly journals provided opportunities for students to express what they learned in written format as well as provided course feedback. An end-of-course reflection paper helped students summarize their successes, and failures during the semester. Peer evaluations placed responsibility on students to work together toward project goals. A student portfolio, consisting of images and summaries of the various landscape projects, kept students involved in the progress throughout the semester and gave tangible evidence of participation. Because of field conditions, assignments were managed through an online course management system. Overall, course evaluations remained similar to those from the traditional classroom version of the course; however, student comments, particularly from the female students, were very positive. Though not quantified, the comments suggest students gained valuable skills beyond landscape construction that they perceived valuable to their future careers.

Horticulture Education Abroad: A Study in Contrasts

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With partial financial support from a grant titled “US and China: An ideal partnership to foster season extension production” awarded by the USDA International Science and Education program, 10 students and three professors from Mississippi, Arkansas, and Florida engaged in a 22-d study abroad course, “Season extension horticulture in China,” in 2010. The goals of the project were to internationalize the season extension production technology for students in southeastern US to prepare them as the leaders of the next generation in agriculture, and to improve research and outreach programs in season extension production to strengthen and broaden undergraduate education. The short-term impact included direct international exposure and initiation of collaboration between American faculty and Chinese scholars. The long-term impact would be to enhance the international content of curricula, retain current students, and improve future enrollment in agriculture, and to provide important resources for future emerging problems for season extension production in both US and China. The group not only visited season extension production and marketing, sustainable agriculture and specialty crop production, but also visited universities and agriculture research institutions and had formal and informal discussions with their peers in China. Pre- and post-tour tests, trip journal, and a short essay revealed that after the trip students had better understanding of season extension production and marketing, Chinese culture and agriculture.

What Makes Retention Possible?

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Data tell us that universities lose approximately 1 billion dollars from attrition of freshman-year students. Those most likely to drop out are low-income, minority, and first-generation college students. This happens because of lack of preparation and academic support. This starts in the home and continues through public school. At the university level there are many weak advisors (advising done not by faculty advisors but by graduate students, administrative assistants, etc.), or the mentors are nonexistent, or students do not seek them out. Research shows that African American students need social support, bonding, and group cohesiveness. What can we do? Do not set students up for failure; improve our advising. Identify at-risk students as soon as possible. Start mentoring programs and provide a meaningful learning environment.

Cultivating Global Leaders in Agriculture: A Successful Attempt to Create International Learning Experiences for Students in Agriculture

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Among the objectives of the 2009 Higher Education Challenge (HEC) Grant “Cultivating global leaders in agriculture” were: 1) the development of a new course curricula at the baccalaureate level to introduce students to global issues in agriculture, enhance critical thinking and analysis skills, and enable students to conduct research experiments that will directly benefit impoverished communities in the United States; 2) to increase minority enrollment and retention in the College of Agriculture at Texas A&M University by providing unique national research opportunities with international applications; and 3) to provide participants with international experiences that will increase competitiveness and job preparation for careers related to research, extension, and academia. To achieve these objectives, a new undergraduate course (“Cultivating Global Leaders in Agriculture”) was developed and offered in Spring 2010 with an enrollment of 13 undergraduate and three graduate students. At the end of the course, 10 students were selected to conduct an international 4- to 6-week experience in Guatemala or Costa Rica. These students were awarded a grant-funded stipend (ranging between \$2500 and \$3500) based on completion of the course and of an application. The five students that traveled to Guatemala helped in delivering training programs for youth using Junior Master Gardener (JMG) activities and in conducting horticultural programs in rural communities. The five students that traveled

to Costa Rica conducted a series of activities in collaboration with EARTH University, carrying out various gardening and environmental projects, community service projects, either in the field or in the local schools, also using the JMG curriculum. The international experience not only had a profound impact on the students’ lives, but it will also increase their competitiveness and career preparation.

Engaging Underserved Undergraduate Student Populations through Experiential Learning for Careers in the Horticultural Sciences

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Texas A&M University–Kingsville (TAMUK) has received several grant awards from the US Department of Agriculture Hispanic Serving Institutions grant program with the express purpose of increasing the competitiveness of South Texas undergraduate students for graduate school and the job market in agricultural sciences. Undergraduate research projects under the direction of a faculty mentor at TAMUK are aimed at advancing their experiential knowledge and skills of students to know up-to-date laboratory protocols, research methodologies, and professional agriculture-based society involvement. The main points of impact of this project are so that the students will 1) be trained in a “hands-on” laboratory that incorporates the most recent advances in several areas of agricultural research skills; 2) have experiential learning through individual student research projects under the supervision of TAMUK faculty mentors to provide students with opportunities to solve complex problems applicable to real-world needs; and 3) be provided with opportunities for career development in the food and agricultural sciences through presentations at professional meetings and peer-reviewed article publications. This program has led to 100% retention of students in the program to completion of a 4-year degree. Furthermore, 15 out of 30 Hispanic students continued onto graduate school with 10% entering directly into PhD programs after the completion of the BS degree due to their professional horticultural and agricultural scientific preparation by faculty–student mentoring.

International Field Experience: An Effective Approach to Enhancing Organic Agriculture Curriculum

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A partnership between the University of Florida (UF) and Polytechnic University of Madrid (UPM) was initiated in 2008 to foster international collaborations in organic agriculture education program development. As a result, a study abroad course and an international internship have been established and implemented to provide experiential learning opportunities and international field activities for undergraduate students in the organic crop production specialization within the horticultural science major at UF. The two-credit course on organic production and marketing in Spain offers students exposure to organic farms, processors, and distributors in Spain. Students are expected to obtain a comprehensive understanding of European organic food systems and regulations as compared with those in the US. A daily travel journal and a comparative final report are required as assignments to enhance their experiential learning and stimulate critical thinking. Feedback from participants indicated that the study-abroad course is a successful complement to the organic crop production curriculum for increasing students' competence and competitiveness in the global organic agriculture arena. Teaching materials developed from the international field study have been incorporated into organic production courses at UF. An undergraduate student from the Horticultural Sciences Department at UF completed a 3-month internship at UPM in Spring 2010. The intern helped to develop a questionnaire and conducted a survey to compare production systems and marketing strategies of organic farms in Florida and Madrid. The post-internship interview with the student revealed that the international internship experience was effective in terms of increasing direct exposure to the global organic agriculture industry, improving technical communication skills, and providing professional development.

Extension Section

Using Facebook to Provide Clientele with Horticultural Information

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Since Fall 2009, LSU AgCenter horticulturists have been providing home and commercial horticultural information to clientele via social media, primarily Facebook. This includes postings on the LSU AgCenter, Louisiana State Horticulture Society (LSHS), and Louisiana Nursery and Landscape Association (LNLA) Facebook pages. The LNLA Facebook page started in Fall 2009. There are 248 "fans or friends" of this page with 129 monthly active users and about 70 visits weekly. Items posted on the LNLA page include awards, meeting announcements, and nursery/landscape horticulture-related information. The Facebook page for the LSHS was launched in early 2010. About 550 individuals are "fans or friends" of this site with 227 people being active monthly users with 52 visits weekly. Most information posted on the LSHS site is home horticulture related. The LSU AgCenter Facebook page has research and extension information. Active monthly users are 766 with over 1300 individuals being "friends or fans." The LSU AgCenter

Facebook page has 388 visits weekly. On the LSU AgCenter Facebook page, 60% of postings contain horticulture information. Facebook has been a quicker, faster method of providing horticulture information to clients. It is faster to post items than webpages but lacks detailed information. More contacts are possible than with webpage postings. It is a way to maintain contact with clientele who you may not normally interact with on a regular basis.

Helping Growers Understand the New Fumigant Management Plans

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Fumigants are currently used for plasticulture-grown vegetables in Miami-Dade County: tomatoes, peppers, eggplants, and strawberries. New rules for using fumigants date from 1 Jan. 2011. Changes include product stewardship training requirements, buffer zones, number of acres treated per day, record keeping, and notification, especially of neighbors. The author held an interactive meeting for local growers in Oct. 2010, reviewing the changes. The meeting was like a combination grower workshop/advisory committee meeting. Growers were concerned about fumigant options, training requirements, fit tests, buffer zones, notification, and fumigant Good Agricultural Practices compliance. They realized that these requirements would require significant changes to their operations, especially for record keeping. As a result of the workshop, growers prioritized several issues for Extension: assistance with understanding how buffer zones can work, having meetings with manufacturers for both product information and training for growers and their fumigant handlers. Growers would like to have two sessions of handler training, one in April and one in the fall. Local suppliers have requested Extension's assistance in staying up-to-date on these regulations. This meeting was an excellent way to start a much-needed dialogue about this issue.

Small Acreage Horticultural Crops: A Webinar-based Model Plan

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Horticultural products are of high value and result in greater potential for per-acre returns and production costs than grain crops. However, because of their high cost of production, perishable nature, and direct marketing, most horticultural producers in Texas face more challenges and many businesses fail due to lack of proper preparation. A webinar-based model plan was developed to assist small-acreage vegetable producers in identifying and evaluating diversification strategies for risk mitigation and improved economic sustainability. In addition to online resources on site selection, marketing, crop guides and cultivar selection, three webinars were held in 2009–10 on varied topics such as grapes, small fruits, pecans, vegetable

production, high tunnels, and marketing. Attendees were asked to fill out an evaluation form after each webinar with questions on the level of understanding, intent of adoption, and anticipated savings in dollars per acre. A total of 403 participants attended and submitted their evaluation forms. Evaluation data indicated an increase in knowledge of 43% to 70% was achieved after attending the webinars. Based on an average of \$240 in anticipated savings reported in the surveys, the three webinars resulted in about \$96,000 in total savings. An additional \$1040 per speaker per webinar was saved in travel expense.

Rolling the Dice: Risk Management for Specialty Cut Flower Growers

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A collaborative team from three land-grant universities hosted a regional specialty cut flower workshop in Memphis, TN, in Nov. 2009. The workshop was supported by a grant from the Southern Region Risk Management Education Center (RMEC). A number of factors contributed to the success of this workshop. These include the use of an event planning service, professionally designed workshop graphics, nationally recognized speakers, RMEC funding to reduce registration fees, and concurrent educational tracks that were recorded to provide all attendees with the same information. Using an immediate audience response system, the team determined that a majority (74%) of attendees were currently growing cut flowers. Seventy-eight percent of growers produced cut flowers on 4.9 acres or less. The primary (67%) marketing channel for growers was a farmer's market. The number one (32% of respondents) challenge for growers was labor. No respondents use the land-grant university/CES as their primary source for information. Three months after the workshop, attendees were surveyed by mail. As a result of attending this workshop, attendees were able to improve the management of their firm's production, marketing, financial, labor, and/or legal risks. As a result of attending this workshop 52% changed their crop schedule or operation practices, 56% diversified their products or services, and 48% enhanced their business pricing and/or record keeping processes.

A Low-cost High Tunnel Demonstration Program in Kentucky

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Interest in high tunnel vegetable production has increased recently. From 2008 through 2010, a high tunnel demonstration program was conducted in Kentucky utilizing a low-cost high tunnel design. A demonstration high tunnel measuring 3.7 m

wide × 29.3 m long cost approximately \$400 to build and was assembled on site in 3–4 h. This low-cost design allowed for the construction of 14 demonstration tunnels in 13 counties across the Commonwealth of Kentucky in 3 years. As a result of the demonstrations, there have been seven field days and workshops with approximately 800 attendees. Interest from the demonstration program has led to 25 county-level meetings detailing high tunnel production and regionally specific production information for high tunnel growers. Returns from demonstration tunnels have varied based on the crop produced and market outlets. Returns for spring-grown tomatoes ranged from \$13 to \$67/m². Income for organically managed vegetables produced in tunnels ranged from \$22 to \$56/m² between 2008 and 2010. Returns were typically higher per unit area for growers who marketed particularly early in the season or had a unique niche on which to capitalize. This high tunnel demonstration program has allowed for the successful dissemination of novel production techniques as well as providing useful production and marketing data for growers considering high tunnels in Kentucky.

Large-scale Net House for Vegetable Production: Pest Management Successes and Challenges (Year 1)

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Vegetable producers in the Deep South suffer major crop losses due to insect pest outbreaks. Physical barriers, such as row covers, are commonly used by producers to prevent insect damage to crops. However, a net house vegetable production system has not been evaluated in the United States. This is the first report regarding the effectiveness of a large net house, constructed in 2010, for producing high-value crops in southern Alabama. The net house is a 46 m × 14 m structure constructed using wooden poles, support cables, and several long pieces of 50-mesh insect netting manufactured by PolyProductos De Guatemala S.A., Guatemala. The unit is 5 m high in the center and 4.2 m high on the sides. The net house was sealed by tucking the sidewalls 0.3 m below the soil surface. A double-door provided access inside the unit, where bell peppers and tomatoes were hand-transplanted in mid-May. Insect pest activity was monitored in the net house as well as outside (untreated control plots) using wing pheromone traps. Plants were also scouted directly to determine pest pressures. The net house significantly excluded the moths of tomato fruitworm (*Helicoverpa zea*) and beet armyworm (*Spodoptera exigua*) compared to the open field. Direct scouting revealed that armyworm (three species) and tomato hornworm (*Manduca quinquemaculata*) caterpillars were reduced 98% to 100% under the net house. Leaf-footed bugs (*Leptoglossus* sp.) were also undetectable on plants grown inside, whereas open-field tomatoes were damaged by the insect. Major challenges included high humidity and temperature inside the unit that facilitated root rot and aphids; the latter had to be controlled with one application of a selective insecticide for the entire season. Future net house research will focus on the management of diseases and insects

with bio-based and cultural tactics. Use of net house for season extension also needs further investigation.

eViticulture.org: A National Grape Community of Practice

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In 2009, a national grape community of practice (GCoP) was formed with eXtension as the platform. The group was funded by a USDA-NIFA-SCRI grant and considered a national priority by the National Grape and Wine Initiative (NGWI). The GCoP launched a companion portal site to eXtension.org/grapes in 2011 called eViticulture.org. The new site leads users directly to viticulture-related information on the eXtension.org site without having to navigate through other content. To date, the GCoP has more than 60 members from 28 states. Members interact through a variety of methods and create content collaboratively on the eXtension site. The ultimate goal of the GCoP is to become the “one-stop-shop” for viticulture information by providing commercial growers access to information about all aspects of growing and producing grapes through an internet-ready method. So far, over 500 pages of content have been created and posted through a peer-reviewed process. Translation of articles into Spanish is also a priority to increase accessibility to vineyard workers and international information seekers. The eXtension platform allows for unique interactive technologies such as “Ask an Expert,” where growers can ask a question and have it answered by a national expert within a short period. Future applications will focus on interactive learning modules, videos, webinars, certificate courses, smart phone applications, and other technologies.

Floriculture, Ornamentals, and Turf Section

Use of IBA and IBA+NAA Solutions for Softwood Cutting Propagation of Selected Ornamentals

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The availability of unrooted cuttings from offshore producers in recent years has made it increasingly possible for growers to propagate a wide assortment of crops without the need to maintain their own stock plants. Softwood cuttings from intensively managed stock plants may or may not benefit from a basal quick-dip in auxin prior to sticking, and may respond differently than cuttings obtained from conventional container-grown or landscape-grown stock plants. Auxin solutions were prepared by diluting Dip 'N Grow concentrate (10,000 ppm IBA + 5000 ppm NAA) to final concentrations of 1000 ppm IBA + 500 ppm NAA and 500 ppm IBA + 250 ppm NAA, and by diluting Dip 'N Grow Lite concentrate (experimental formulation with 10,000 ppm IBA) to final concentrations of 1000 ppm IBA and 500 ppm IBA. Solutions were prepared with isopropyl alcohol and deionized water to contain 50% alcohol (by volume) in the final product. Softwood cuttings were shipped from Colombia on 10 Mar. and received on 12 Mar. Cuttings received a 1-s basal quick-dip in their respective auxin solutions (cuttings in one treatment were not treated with auxin), inserted into 50-cell trays in Fafard 3B substrate using a completely randomized design, and placed under intermittent mist in a greenhouse. There were 40 cuttings per treatment for a total of 200 cuttings per variety. After one month, cuttings were removed from the plug trays and washed to remove substrate. Root systems were scanned and analyzed using WinRHIZO software to determine total root length. Terminal, 3-cm cuttings of *Agastache* ‘Tutti Frutti’ rooted best using a quick-dip in 1000 ppm IBA or 1000 ppm IBA + 500 ppm NAA. Terminal, 5-cm cuttings of *Buddleja davidii* ‘Attraction’ rooted best using a quick-dip in 500 ppm IBA or 500 ppm IBA + 250 ppm NAA. No auxin treatment was necessary for terminal, 2.5-cm cuttings of *Rosmarinus officinalis* ‘Arp’.

Plant Age and Cultivar Affect Western Flower Thrips Damage on Impatiens

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Western flower thrips [*Frankliniella occidentalis* (Pergande)] has become an increasingly significant pest problem in greenhouse ornamental production. Alternative strategies are needed to manage this pest because of the limited number of available products and the ability of thrips to develop resistance. It is essential to evaluate thrips damage and to develop action thresholds for the implementation of either conventional or alternative management programs. This study was conducted to better understand the damages caused by thrips on thrips-susceptible and resistant impatiens (*Impatiens wallerana*), ‘Dazzler Violet’ and ‘Super Elfin Red’, respectively. Plants at week 3, 6, or 9 in their production period were inoculated with 0, 25, 50, or 75 female adult thrips. Thrips were allowed to feed and develop on plants for a week

and were removed by insecticide sprays. Plants were grown in the greenhouse for another 3 weeks and their responses to thrips damages were evaluated by weekly observations. Visual damage ratings and number of leaves exhibiting damage increased when thrips inoculation density increased. Younger plants exhibited more damage at lower thrips density compared to older plants. A survey was conducted to evaluate consumer tolerance to thrips damage. Leaf damage caused by 25 adult thrips feeding for 1 week on 8-week-old impatiens plants were considered minor and tolerated by most survey participants. These results suggest that thrips management can be tailored by plant age and there is a potential to use alternative controls while still maintaining marketability of impatiens.

Partial Rootzone Stresses and Flower Yield and Quality in Roses

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Greenhouse rose production (for cut flowers) is a most intensive cropping system that utilizes very high water and fertilizer inputs, and whose large drainage effluents are being captured and considered to be recycled back into production, along with the increasing use of alternative, poor-quality irrigation waters. 'Revival' rose plants (grafted on the rootstock 'Natal Briar') are being grown in a split-root system. One-half of the roots receive a standard nutrient solution (EC = 1.7 dS/m; pH = 6.2) and the other half receives the same solution alone or supplemented with salinity (30 mM NaCl, EC = 4.7 dS/m), alkalinity (6 mM bicarbonate, pH = 8.1), high boron (1.8 mg/L) or a high NH₄-N fraction (48.5%, supplied with urea). After three flowering flushes no significant differences have yet been found for cumulative flower yields across treatments. Plants receiving the high NH₄-N (urea) fraction on one-half of their roots have had, however, the highest total dry biomass yields, even as they had the highest leachate EC (8.1 dS/m) compared to the plants receiving the partial salt-stress (7.0 dS/m) or other treatments (averaged 5.3 dS/m). Plants exposed to the partial alkalinity and salinity stresses had the shortest stem lengths and lowest foliar chlorophyll indexes. The salt-stressed plants also exhibited the lowest dry weight per stem. These preliminary results suggest that rose plants, at least those grafted on 'Natal Briar', still remain fairly sensitive to rootzone salinity and alkalinity conditions even when afflicting only a partial sector of their root system.

Salt Tolerance of Selected Bedding Plants

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Alternative water sources are being used for landscape irrigation. Alternative water sources contain high salts, which cause salt damage on sensitive plants. Bedding plants are extensively used in landscapes. The objective of this study was to determine the salt tolerance of seven bedding plants: *Angelonia angustifolia*

'Purple', *Gazania rigens* 'Pink Shade', *Gomphrena* sp. 'Fireworks', *Tagetes erecta* 'Gold', and three cultivars of *Petunia xhybrida* 'Baby Duck Yellow', 'Mirage Rose', and 'Spreading'. Seedlings of these plants were grown in 500-mL pots and subirrigated with either nutrient solution (control) at electrical conductivity (EC) of 1.5 dS/m or saline solutions at EC of 2.8, 4.5, 6.5, and 8.2 dS/m, created by adding NaCl, MgSO₄, and CaCl₂ at 85:8:5 to the nutrient solution. *Petunia* plants were transplanted to 2.6-L pots after 18 d of subirrigation in the 500-mL pots and were top irrigated with treatment solutions after 1 week transition. Shoot DW decreased linearly as salinity of irrigation solution increased in all species except for *gomphrena*. As salinity increased, shoot DW of *gomphrena* changed in a quadratic fashion with highest shoot DW occurring at EC of 4.5 dS/m. For *petunias*, plants grow rapidly without salt injury. Since no visual damage exhibited at all, moderate salinity may produce more compact plants compared to the control and may eliminate or reduce the use of plant growth regulators in *petunia*. Among the seven species, *Tagetes erecta* was the most sensitive to elevated salinity because no plants survived in the elevated salinity treatments. In summary, *angelonia*, *petunia*, and *gomphrena* plants are moderately salt tolerant and can be irrigated with saline water up to moderate salinity levels, although shoot growth would be reduced.

Salt Tolerance of Five Wildflowers

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Due to intense competition for fresh water among agriculture, industry, and domestic water users, an alternative water source such as municipal reclaimed water is being used for irrigating landscapes in some areas in the Southwest. The responses of herbaceous perennial wildflowers to irrigation water with elevated salts are unknown. A study was conducted to quantify the impact of saline water at various salinity levels on plant growth, survival rate, and aesthetic appearance of five native wildflower species: *Berlandiera lyrata* (chocolate daisy), *Monarda citriodora* (lemon horsemint), *Oenothera elata* (evening primrose), *Ratibida columnaris* (Mexican hat), and *Salvia farinacea* (mealy blue sage). Five salinity levels at electrical conductivity (EC) of 0.8 (tap water, control), 2.8, 3.9, 5.5, and 7.3 dS/m were created by adding different amounts of NaCl, MgSO₄, and CaCl₂ to tap water. Plants were grown in a shade-house with 25% light exclusion and were irrigated with the above saline solution for 5 weeks. Lemon horsemint did not survive when plants were irrigated with saline solutions at EC of 2.8 dS/m or higher. Chocolate daisy also had low survival rates when plants were irrigated with saline solutions at EC of 5.5 and 7.3 dS/m. Shoot dry weight of all survived species decreased as salinity of irrigation water increased. Based on growth, survival rate, and visual quality, we conclude that lemon horsemint was most sensitive to salin-

ity stress, followed by chocolate daisy. Mexican hat was most tolerant to salinity among the five species. Evening primrose and mealy blue sage were moderately tolerant to salinity.

Lotus (*Nelumbo nucifera*) Plant Plasticity in Response to *S*-Metolachlor Concentration

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Metolachlor [2-chloro-*N*-(2-ethyl-6-methylphenyl)-*N*-(2-methoxy-1-methylethyl) acetamide] is among the most commonly used pre-emergence herbicides for corn and soybean in the United States. Due to their extensive use, solubility and persistence, metolachlor accumulates and impacts surface and ground waters. Asian and Native American lotus species (*Nelumbo* spp.) are perennial water plants that are tolerant to many environmental conditions. In addition, lotus is easy to grow, has high ornamental value, and can be grown in constructed wetlands that treat agricultural run-off. The objectives of this study were to evaluate lotus as a model bio-remediator. Electrolyte leakage (EL), photosynthetic capability (Pn), stomatal conductance (SC), biomass accumulation (FW), total chlorophyll (TC), lipid peroxidation (MDA), and vitamin C content were evaluated as potential biomarkers of stress on the genus *Nelumbo*. Seedlings were treated with varying concentrations of *S*-metolachlor (0.0, 1.0, 3.0, and 5.0 mg·L⁻¹) over a 6-week duration at 2-week intervals. Mature 12-week-old plants were treated with higher concentrations of *S*-metolachlor (0.0, 5.0, 15.0 and 35.0 mg·L⁻¹) over the same intervals. In seedlings, EL, Pn, and SC values were not different when compared to control. However, FW in seedlings showed a quadratic response (0.0–5.0 mg·L⁻¹ *S*-metolachlor) with a corresponding weight reduction of 23.7%. In mature plants, TC content in response to treatments was concentration and duration-dependent. Vitamin C content declined and MDA increased in response to time. Although, the *S*-metolachlor treatments exceed concentrations frequently found in agricultural run-off (5–80 µg·L⁻¹), lotus plants were able to tolerate treatments within the concentrations and durations evaluated. Vitamin C and MDA were more effective than EL as a biomarker. The result of this study suggests that lotus may serve as a potential plant for bioremediation.

China: A Study in Contrasts

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Three land-grant universities hosted a 22-d trip to China in May 2010 with 10 students and 3 faculty. The trip was supported by a grant from the USDA International Science and Education program. The primary focus of the trip was to study high tunnel (HT) applications in horticulture. China is reported to have over 360,000 ha of HT production vs. 5,000 ha in the US. The trip was filled with contrasts and similarities to Green Industry (nursery, greenhouse/cut flower, landscape) businesses in the US. One major contrast between Green Industry businesses in China and the US is the financial structure. In China, businesses can be 100% private, 100% government owned, or a blend of private and public funding. Participation by the Chinese government in commercial businesses may prove challenging for other businesses competing in the global market. In general, many of the production systems used in Green Industries in China were quite similar to the US; however, one significant difference was the large-scale use of low-cost labor. The recent expansion of the Chinese middle class is driving an increasing demand for ornamental products and services. The rapid expansion of large-scale agritourism facilities is one example.

Fruit Section

An Overview of the eXtension “All About Blueberries” Website

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The All About Blueberries Community of Practice (CoP) was created to help blueberry growers in the southeastern United States maximize productivity and decrease production costs. This CoP uses novel, diverse educational methods to help its Community of Interest (CoI) increase blueberry production efficiency and correspondingly increase consumption of blueberries in the southeastern United States. Participating in a CoP is advantageous for agents/researchers in that it allows for enhancement of professional contacts and teamwork, as well as improved awareness of research and extension in other land-grant universities. In addition to these assets, creating and

or being involved in a CoP allows principal investigators (PIs) to learn leadership, organization, and delegation. It allows for exposure to novel tools, such as new software, etc., and it gives opportunities for participation in eXtension workshops. The process for promotion and tenure is being revised to encourage participation in eXtension. The information platform used by a CoP is limitless, including posting You Tube video content, audio and video “podcasts,” online interactive maps, Moodle courses, online interactive diagrams, traditional text and photo webpages, FAQs, Ask the Expert services, and so on. The All About Blueberries CoP is always looking for more experts to join our community. An eXtension ID is required in order to join a CoP. To register for an eXtension ID, go to <http://about.extension.org>.

Blackberry Performance in a Sheltered Environment

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Florican and primocane producing blackberries ‘Kiowa’ and ‘Prime-Jan’ were established in-ground and grown under a 30 ft × 72 ft greenhouse shelter (GHS) to evaluate overall effect on production within a sheltered environment. Training systems consisted of vertical trellis and primocane suppression for ‘Kiowa’ and modified hedge support for ‘Prime-Jan’ using six plants per plot. Comparisons were made between cultivars in GHS and using a replicated study established at the same time without greenhouse shelter (NGHS). Temperature data collected at various intervals during the establishment year showed an increase in heat units (base 40) resulting in 149% increase in plant width and 176% increase in primocane height of ‘Kiowa’ for GHS compared to NGHS. Increase growth rate of ‘Prime-Jan’ was not as pronounced during the same period of time except for primocane height, which was 136% greater with GHS. Extended growth late in the season of plants in GHS appeared to result in cold injury that reduced yields in the second year of the study. Comparison of total yields per plot over a 2-year period showed ‘Prime-Jan’ significantly outperformed ‘Kiowa’ in GHS. Yields were 139.5 lb and 70.8 lb for ‘Prime-Jan’ and ‘Kiowa’, respectively. NGHS production of ‘Kiowa’ and ‘Prime-Jan’ during the study was 50.8 lb and 86.3 lb per plot, respectively. Primocane fruit yields of ‘Prime-Jan’ were nearly double for GHS, 15.3 lb, compared to NGHS, 7.7 lb. Average fruit weight for both ‘Kiowa’ and ‘Prime-Jan’ were 0.5 g larger in GHS vs. NGHS. Fruiting periods of both cultivars were 10 to 12 d earlier for GHS compared to NGHS.

Vegetative Growth Differences in Pierce’s Disease Tolerant Hybrid Grapes during the Years of Vineyard Establishment

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TenPierce’s disease (PD) tolerant hybrid bunch grapes, including ‘Black Spanish’, ‘Blanc du Bois’, ‘Champanel’, ‘Cynthiana’, ‘Favorite’, ‘Lake Emerald’, ‘Seyval Blanc’, and ‘Seyval Blanc’, grafted on 3309 rootstock, ‘Stover’, and ‘Villard Blanc’, planted in 2008, were evaluated during the 2010 season to determine vegetative growth differences during the years of vineyard establishment. The experimental design is a RCBD with four replications and four single vines per replication used as an experimental unit. The vineyard is located at the Sand Mountain Research and Extension Center near Crossville, AL. Results on cultivar pruning weight and vine trunk cross-sectional area showed significant differences between cultivar growth and vigor. Grape cultivars ‘Black Spanish’, ‘Blanc du Bois’, ‘Stover’, and ‘Favorite’ had a relatively low vigor, while ‘Champanel’, ‘Seyval Blanc’, ‘Seyval Blanc’ on 3309, and ‘Villard Blanc’ had vigorously growing vines. Cultivars also differ in their early shoot development and the blooming season. ‘Black Spanish’ had the most advanced early shoot development, and ‘Champanel’ had the earliest bloom season. Differences between the average number of fruiting clusters per shoot were also found that ranged from 12 clusters per shoot for ‘Seyval Blanc’ and 0.9 clusters for ‘Blanc du Bois’. ‘Stover’ and ‘Seyval Blanc’ hybrid grapes had the highest yield during the first cropping season.

Advances on the Performance of Containerized Strawberry Transplants under Diverse Establishment Practices in Florida

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In Florida, strawberries (*Fragaria xananassa*) are established from bare-root transplants using 7 to 12 d of overhead sprinkler irrigation for 8 h/day in late September and early October. In order to reduce agricultural water consumption and relief water sources competition with urban development, containerized transplants could be an alternative to save 80% of water during crop establishment, although their price is double compared to bare root transplants. It might be possible to produce containerized strawberry transplants with successful flower initiation induced by the correct red light to far-red light ratio in Florida. Therefore, optimal plug sizes for production of containerized transplants in Florida need to be determined. ‘Strawberry Festival’ strawberry was used for plugging into four tray cell numbers: 36, 40, 50, and 72 cells per tray. The red light to far-red light ratio at crown was significantly lower with transplants from 36 cells per tray (0.48) than from 40 (1.08), 50 (1.07), and 72 (1.20) cells per tray. Trays with 72 cells produced plants with the smallest crowns at both 6 and 12 weeks after transplanting (WAT) compared to other cell sizes, whereas there was no significant difference among trays with 36, 40, and 50 cells at 6 WAT and the largest crowns were produced with of 72 cells

per tray at 12 WAT. Plant size was larger when trays with 36 cells were used compared to with 72 cells at 6 WAT, but this difference was recovered at 12 WAT. Both early fruit number and early yield were higher with plants from 36 cells per tray than 72 cells per tray, and the results of 36, 40, and 50 cells per tray were not significantly different. Therefore, cell size for strawberry transplant production in Florida can be improved from 36 cells per tray into 50 cells per tray without affecting production; however, for trays with cell number as many as 72 may limit transplant growth and even affect the performance after established in the field.

Influence of Rootstocks on Physiology of ‘Cabernet Sauvignon’ Grapevines Grown on the Texas High Plains

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Because of extreme growing conditions found on the West Texas High Plains, there is a great need for growers to select adapted varieties and rootstocks. To assist growers when selecting varieties and rootstocks adapted to the region, this study investigated rootstock effects on physiology of field-grown ‘Cabernet Sauvignon’ grapevines. Research took place at a local vineyard near Lubbock, TX. *Vitis vinifera* ‘Cabernet Sauvignon’ scions grafted to nine rootstocks were used: 1103P (*V. berlandieri* × *V. rupestris*), 3309C (*V. riparia* × *V. rupestris*), 420A (*V. berlandieri* × *V. riparia*), 5BB (*V. berlandieri* × *V. riparia*), Freedom (1613C × *V. champini*), Harmony (1613C × *V. champini*), Riparia (*V. riparia*), SO4 (*V. berlandieri* × *V. riparia*), and own rooted. Vines were planted Spring 2008 in a completely randomized block design. For each rootstock and scion combination there were a total of 25 plants in each block. Irrigation was delivered by buried drip tape, and all plants received similar irrigation volume. During the 2010 growing season stomatal conductance, leaf to air vapor pressure deficit, transpiration rate, and photosynthetic rate were measured on four different dates. Seasonal physiological means were exposed to ANOVA. If differences were detected, means were separated by Fisher’s least significance difference procedure. Physiological means were different between rootstocks for stomatal conductance, transpiration, and water use efficiency. Despite descriptions of low to high drought resistance of tested rootstocks, our data indicate during the 2010 growing season physiological differences between ‘Cabernet Sauvignon’ scions and rootstock combinations were not consistent and favored no particular rootstock. Although other considerations must be made when selecting rootstock scion combinations (vigor, bud-break, disease resistance, etc.), physiologically it appears each rootstock tested may be suited to growing conditions found on the West Texas High Plains. To further assist producers on the West Texas High Plains additional physiological and production (fruit quality, pruning weights, etc.) data will be collected during the 2011 growing season.

Field Evaluation of Tissue Culture Banana in the Northern Mariana Islands

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Banana growing has recently become more important in terms of production and food security in the island communities of the Commonwealth of the Northern Mariana Islands (CNMI) as compared to the past, where Black Leaf Streak and Banana Bunchy Top diseases have constrained the production of bananas. New lines of banana tested in the South Pacific Islands have been introduced into the Commonwealth and have captured the interest of rural village farmers. Shortages of vegetative planting material, high production cost, natural disasters, insect pests, and diseases are the current critical gaps in achieving increase of banana production. Field trials of new varieties of tissue culture banana were conducted throughout the CNMI from 2007 to 2010. New varieties were introduced through the regional germplasm center of the Secretariat of the Pacific Community, Fiji, and established at the As Perdido Agriculture Experiment Station of Northern Marianas College—Cooperative Research, Extension and Education Service (NMC-CREES) in the islands of Saipan, Rota, and Tinian. New varieties were propagated through tissue culture technique and have been tested in the three islands of the CNMI. Introduced varieties were evaluated for their superior agronomic characters, such as high yield, disease and pest resistance, growth, and taste. Twelve new varieties of banana, cooking and dessert, have been evaluated and three crop cycles have been accomplished successfully in all three main islands of the CNMI. Several hundred plants of new varieties were propagated in-vitro and distributed to the farming community for their commercial production. This paper describes results obtained from FHIA banana variety trials introduced from the certified institutions and field evaluations in the CNMI.

High Tunnel Production of Papaya (*Carica papaya* L.) as an Alternative Niche Crop for Southern Virginia Growers

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Papaya, *Carica papaya* L., is native to southern Mexico and parts of Central America. Papaya is planted worldwide under tropical climate conditions. Papaya is one of the few tropical fruits that has crossed over to the American market, largely due to its sweet taste and nutritional value, and its consumption is on the rise in the US. It is not possible to grow papaya under field conditions in Virginia due to a short growing season. We investigated Virginia papaya production in high tunnel conditions. Two papaya fruits from a local supermarket were purchased; seeds were removed, washed, and dried under room temperature. The

seeds were planted in Dec. 2008 in a greenhouse. Five plants were transplanted in the ground in a 48 × 21 ft high tunnel. Papaya plants initiated flowering in June and continued until December. The first year's fruit never ripened and green fruits were harvested, used in a green papaya salad recipe, and promoted among local chefs. In Dec. 2009, a secondary, temporary structure was constructed inside the high tunnel to protect the plants from cold temperature. In Dec. 2009, the main stem of each plant was removed 2 ft above the ground and all the lateral shoots were removed but one. The single lateral shoot of each plant grew and initiated flowering in Apr. 2010. The second year fruits ripened and were harvested and test marketed from Sept. until Dec. 2010. A total of 15 ripened fruit were harvested from each plant. The average fruit weight was 2 lb.

Using Kaolin Clay to Reduce Sprinkler Irrigation for Strawberry Transplant Establishment

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Strawberry production in Florida uses the annual hill system to supply fresh fruit during the winter market in the US. Growers rely on bare-root strawberry transplants to establish the crop from late September to late October. To achieve this, sprinkler irrigation is applied during 10 to 14 consecutive days between 12 to 14 h/day to reduce the temperature around strawberry crowns. Because of the current limitations of water usage for strawberry growers, production practices aimed to minimize the sprinkler irrigation without affecting net income are desirable. Crop protectants, such as kaolin clay, are designed to reduce sun-scalding in fruit crops and vegetables. Two field studies were conducted to evaluate the plant establishment and early fruit yield of strawberries established with and without kaolin clay application. Seven combinations of number of days of sprinkler irrigation (4 gal/min per sprinkler; 10 h/day) and timing of kaolin clay application were established: 10 d of sprinkler irrigation (control), 8 d of irrigation plus or minus kaolin clay on the 9th day, 6 d of irrigation plus or minus kaolin clay on the 7th day, and 4 d of irrigation plus or minus kaolin clay on the 5th day. The results showed that the application of kaolin clay on the strawberry foliage the following morning after either 6 or 8 d of sprinkler irrigation had the same plant establishment, plant canopy diameter, and early fruit weight as the 10-d irrigated control. Therefore, a 40% reduction of establishment irrigation volumes can be achieved with the application of kaolin clay, which might represent major water savings for strawberry production in west-central Florida. The white film of kaolin clay dissipated within 3 to 5 weeks and it did not show reduction on plant growth, flowering, and yields. No effects on total fruit weight were observed during the seasons.

'White Diamond' Peach

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'White Diamond' peach is the fifth white-flesh peach released from the University of Arkansas. It is a late-season maturity freestone with very firm flesh that softens when fully ripe and is low acid in flavor. 'White Diamond' resulted from a cross of Ark. 392 × 'White River' made in 1994. It was selected in 1998 and was designated Ark. 700. 'White Diamond' first ripe date averaged 31 July (average 128 d after full bloom) at Clarksville, AR. Average fruit weight for 'White Diamond' was 208 g on samples from observational trees, heavier than 'White Rock' but less heavy than 'White County' and 'White River'. 'White Diamond' fruits are freestone and flesh is crisp at early ripening (which are of harvest quality) and soften when fully ripe. Flavor is a light white-peach type and low acid. Its flavor is much like that of the low-acid cultivar White County. Soluble solids averaged 14.6%. Tree health was rated high for 'White Diamond', primarily due to its resistance to bacterial spot, a disease that can be quite severe at Clarksville. 'White Diamond' was observed to have only light leaf infections of bacterial spot in some years of evaluation, even with bactericides applied. Among comparison cultivars, 'Carolina Belle' and 'Nectar' had more instances of bacterial spot on leaves than the Arkansas cultivars. This cultivar expands options for growers in the mid- to the upper-southern United States and other areas of the world with similar climatic conditions.

Vegetable Crops Section

Quantifying Ascorbic Acid, Flavonoid, and Capsaicin Levels in Different Peppers (*Capsicum annuum*) Grown in Two Different Texas Locations

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Hot peppers (*Capsicum* spp.) are an important vegetable ingredient in many cuisines. They contribute to the color, flavor, aroma, and overall appearance of our meals. Peppers also serve as a unique avenue for delivering many of the important phytochemicals needed by our bodies to maintain a healthy lifestyle. For several years now, Texas A&M University has been developing pepper germplasm expressing various traits of importance. In 2010, nine different experimental pepper (*Capsicum annuum*) hybrids were planted at two different Texas Agri-Life research locations (Uvalde and Weslaco) in completely randomized de-

signs. Plants were grown using commercial practices, and fruit were harvested and relocated to College Station, TX. Peppers were held at -80°C until analysis ensued at the analytical core unit of the Vegetable and Fruit Improvement Center. 100% methanol was used to extract both capsaicinoids (capsaicin and dihydrocapsaicin) and flavonoids (quercetin and luteolin) while 3% meta-phosphoric acid was used to extract ascorbic acid out of fruit tissue. Extract samples were inserted into a high-performance liquid chromatography (HPLC) machine to complete the analysis. A 4- μm Nova-Pak[®] C₁₈ column (45% ACN in water, 280 nm, 1.00 mL/min, 20 min), a 4- μm Nova-Pak[®] C₁₈ column (0.5% H₃PO₄ in water + 0.5% H₃PO₄ in methanol, 360 nm, 0.80 mL/min, 20 min), and a 10- μm Bondapak[™] NH₂ 125A column (70% ACN in water with ammonium dihydrogen phosphate, 254 nm, 1.00 mL/min, 10 min) were used for capsaicin, flavonoid, and ascorbic acid analysis, respectively. Significant differences, as expected, were found in phytochemical expression (except for the location effect for capsaicin) in these selected entries. Fruit grown at the Weslaco location had higher ascorbic acid and, in most cases, capsaicin values. Fruit grown at the Uvalde location had higher flavonoid values. Cayenne entries had significantly higher concentrations of flavonoids and ascorbic acid values than other types. For the most part, serrano and jalapeno entries had significantly higher concentrations of capsaicin values than cayenne. Evidence suggests this material could be useful in different crossing schemes or ultimately released for the purpose of providing consumers with a healthier choice having appreciable visual attributes.

Spray Application of Abscisic Acid Phytohormone Can Improve Drought Tolerance and Potentially Provide Short-term Growth Inhibition in Tomato Transplants

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Abscisic acid (ABA) was the last class of phytohormone to be commercially developed. The creation of efficient methods for the production of ABA through fermentation spurred the commercialization of ABA. In 2010 Valent BioSciences Corp. received US EPA registration for two new biorational agrochemicals based on the active ingredient ABA: one is used to improve the red color of grape berries, while the other is used to improve the drought tolerance of ornamental plants. The new registrations for ABA do not allow the product to be used on food crops to improve drought tolerance. Due to the importance of vegetable transplants in the US vegetable industry, we decided to conduct drought tolerance experiments on tomato (*Solanum lycopersicum* L.) transplants. In our 2010 greenhouse tests, drought tolerance in tomato transplants was significantly improved with spray applications of ABA applied to the point of run-off. We tested transplants in trays obtained from a commercial producer and we potted single commercial transplants into 600-mL pots, grew them in the greenhouse for 1 week to acclimate, and then applied ABA. Time to wilting in unwatered transplants in 600-mL pots was increased in a dose-dependent manner over the

spray concentration range of 500 to 2000 mg·L⁻¹ a.i. Time to wilting was increased from 2 d in the control plants to almost 4 d on average in the transplants sprayed with ABA at 2000 mg·L⁻¹ a.i. We found that spray adjuvants commonly used to improve the spreading and adhesiveness of spray mixtures onto leaf and fruit surfaces could improve the efficacy of the ABA sprays. Short-term growth inhibition was another objective of our research project on vegetable transplants. The growth rate of transplants was reduced significantly by high-dose ABA sprays of 1000 to 2000 mg·L⁻¹ a.i., but transplant growers we worked with in Florida and Georgia said that short-term growth control was not an important goal for them. These growers were interested, however, in a product that could improve drought, chilling, or freeze tolerance. Rapid cotyledon senescence was the most common side effect after the ABA sprays, but leaf yellowing and necrosis also occurred occasionally at the highest rates we tested.

Weed Control in Watermelons Using Reflex[®]

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A herbicide trial was conducted in a commercial seedless watermelon field (var. Tri-X 313 with Jamboree as a pollenizer) north of Monte Alto, TX (loamy sand). Four different rates (12, 16, 24, and 32 oz/acre) of Reflex[®] (fomesafen) were made with a CO₂ backpack sprayer on 1 Apr. prior to the transplanting. The applications were applied to bare ground on both sides of the plastic (45-inch swath × 15-ft-long plots). Each of the plots had a haygrazer (var. Jack Pot) windbreak on each side about 6 inches tall on 1 Apr. Evaluations for transplant injury were done on 22 Apr. (10 DAP), 28 Apr. (16 DAP), and 13 May (31 DAP). No injury was observed on the watermelon transplants on any of the evaluation dates. However, injury to the haygrazer was observed on 22 Apr. and plants were dead on 28 Apr. A weed control evaluation was conducted on 28 Apr. (16 or 27 DAT), in which all weed species were counted in the plots. The main weed species included grasses such as crowfootgrass (*Dactyloctenium aegyptium*), Texas panicum (*Urochloa texana*), and one broadleaf common purslane (*Portulaca oleracea*). During this evaluation only the Reflex[®] treatments did not have any common purslane while the untreated control and the grower local standard had common purslane in the plots. An untreated control and grower local standard were included in the trial with the untreated control evaluating watermelon transplants that were planted on 12 Apr. However, the local grower standard could not be duplicated, so randomized plots within the treated area were left as they were with these watermelons being planted on 4 Mar. 2010 with mechanical weed cultivation and a shielded lay-by application of the Treflan[®] (12 oz/acre) on 6 Apr. Another weed control evaluation was conducted on 13 May (31 or 43 DAT) and all grass species were dead in the plots because of broadcast application of Select[®] on 3 May mainly to kill the haygrazer windbreaks. Therefore, only broadleaves were evaluated on this date and the only broadleaf was common purslane. The Reflex[®]

application at the 32 oz/acre and 24 oz/acre provided statistically significant control in comparison to the other Reflex® rates, untreated control, and local grower standard. Overall, Reflex® provided an excellent control of common purslane, which is quite a troublesome weed in the production of watermelons in southern Texas with the 32 and 24 oz/acre rates.

Evaluation of New Experimental Tomato Hybrids from the Texas A&M Vegetable Improvement Center

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The tomato breeding program at Texas A&M AgriLife Research–Weslaco has been developing improved germplasm for over 60 years. The primary objectives have been improvement of heat tolerance, yield, disease resistance, and fruit quality for adaptation to southern Texas. Multiple elite cultivars and breeding lines have been released to enhance competitiveness of Texas producers for the processed market, primarily diced and whole, canned tomatoes. These have included greatly enhanced heat tolerance and yield, as well as resistance to diseases such as fusarium and southern blight. Currently, the program has expanded to include fresh-market types, with a stronger emphasis on virus resistance, flavor, nutritional content and consumer appeal. More than 5000 new breeding lines have been developed to incorporate these traits into heat-tolerant cultivars, adapted to south Texas. Improvements in fruit size and yield of beefsteak and heirloom-types, with resistance to fusarium and TYLCV have been accomplished. Yields of these determinate lines have exceeded 500% of traditional large-fruited and heirloom cultivars in replicated field trials at Weslaco. In addition, fruit firmness and shelf-life have been improved, without using the RIN gene, allowing for superior flavor. By combining the Ty-2 and Ty-3 genes, much greater resistance to a diverse population of begomoviruses has been achieved. In addition, genes for resistance to TSWV and late blight are currently being incorporated to address those diseases for a wider region of Texas. One new TYLCV resistant processor has been released to a large cannery and additional experimental F1 hybrid FM cultivars are under evaluation, with anticipated release in 2012.

Using Summer Cover Crops for Fall Vegetable Production

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A field experiment was conducted in Baton Rouge, LA, to evaluate the growth and yield of two summer cover crops, sunn hemp (*Crotalaria juncea*) and sesame (*Sesamum indicum*), planted at two timings during the summer. Sunn hemp (44 kg·ha⁻¹) and sesame (5.5 kg·ha⁻¹) were broadcast at recommended rates on 10 June (early planting) and 17 July 2010 (late planting) into 3.7 x 18.4 m plots using untreated seeds. After planting, seeds were incorporated using a fence harrow. Plots received no irrigation, fertilizer, or pesticides prior to or during growth. On 15 Sept. 2010 a 1-m² area of cover crop and weed shoot mass was sampled and soil sampled. Cover crop plots were harvested by a forestry cutter, flail mower, and then incorporated by multiple passes of a disk harrow. Stand establishment was good for all of the plots and weeds were less than 5% of total biomass in all plots. Cover crops height was highest for the early planted sunn hemp (3.3 m), compared to late sunn hemp (2.4 m) and early planted sesame (2.4 m) plot while the late sesame plot was the shortest (1.9 m). Total fresh weights were highest from the early planted sesame and sunn hemp (1.96 kg·m⁻² and 1.92 kg·m⁻², respectively) while the dry weight of the early planting of sunn hemp (0.56 kg·m⁻²) was greater than the other cover crops treatments. There were no differences in soil organic matter or soil nutrient status at cover crops harvest.

Effects of the Soil Surfactant IrrigAid Gold® on Nutrition and Water Management for Tomato Production in Florida Spodosols

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Tomato (*Solanum lycopersicum*) production in Florida mostly occurs in deep sandy Spodosols, which have low water retention and high potential for nutrient leaching. Studies were conducted to determine the influence of IrrigAid Gold (10% alkoxyated polyols and 7% glucoethers) application on the petiole sap NO₃-N concentration, and tomato growth and yield. Treatments consisted of combinations of three N rates (250, 300, and 350 lb/acre) and IrrigAid Gold application (control and applied). The IrrigAid applied plots received 0.5 gal/acre at transplanting and 0.25 gal/acre at 2, 4, and 6 weeks after transplanting (WAT) through drip injection. The results indicated that there were no significant N rate by IrrigAid Gold application interactions for leaf greenness, soil moisture, and early and total marketable yields. Application of IrrigAid Gold increased soil moisture by approximately 2% throughout the season, whereas early marketable fruit weight improved by 11% and 9% in Spring and Fall 2010. These fruit weight increases might be attributed to the increased soil moisture around roots, which reduced nutrient leaching and thus higher N absorption.

Vegetable Yields in Mississippi High Tunnels: First Year Results

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Our team is using a combination of replicated and observational trials to evaluate vegetable crops for production in high tunnels. Our unheated, passively vented tunnels are at Crystal Springs, MS, on a silt loam soil. Crops screened have included Asian greens, heading and leafy brassicas, lettuces, cucumbers, squash, tomatoes, eggplant, peppers, and more. A Spring 2009 replicated test of trellised slicing cucumbers in three adjacent tunnels revealed large inter-tunnel variation in total and marketable fruit number and yield, but almost no variation in average fruit size in the two classes. Based on crop growing days, crop spacing, actual yields, and estimated retail value, theoretical gross income from cucumbers the three tunnels ranged from \$1.39/sq ft/year to \$3.15/sq ft/year. An unreplicated trial of several tomato cultivars illustrated large differences in returns among cultivars. The highest yielding cultivar tested, ‘Roma’, produced a theoretical return of \$3.28/sq ft/year, while the lowest yielding cultivars in this trial produced estimated gross incomes of \$1.82/sq ft/year. The yields and the return estimates produced by these preliminary trials are illustrative of the variability one might encounter in high tunnel production. They are not suitable for actual budgeting purposes because they only represent a single year of work, and in the case of tomatoes, are not based on replicated plots.

Rootstock Effect on Root-knot Nematode Resistance in Tomato

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Cultural practices such as crop rotation and cover crops may be of limited use in controlling root-knot nematodes (*Meloidogyne incognita*) in vegetable production because of the wide host range. Soil fumigation is employed primarily in large-scale commercial production of tomatoes in Florida. Interest in vegetable grafting technology as an alternative tool for pest management is emerging among tomato growers recently. This study was conducted to determine the effectiveness of using rootstocks to improve root-knot nematode resistance in tomato production. In a greenhouse inoculation experiment, a susceptible tomato cultivar, ‘Florida-47’, was grafted onto four resistant rootstock cultivars including ‘Beaufort’, ‘Maxifort’, ‘Multifort’, and ‘RST-04-106’. Non-grafted and self-grafted ‘Florida-47’ plants were used as controls. Six-week-old tomato plants in pots were inoculated with *M. incognita* race 2 by delivering a suspension of 100 juveniles in 4 cm³ water into a 1-cm-deep depression at the base of the plant, and then covering with soil. Nine weeks after inoculation, root-knot nematode infestation was evaluated using a 0–5 rating scale (0 = no galls; 5 >100 galls). Root galls

were not found in plants grafted with ‘Beaufort’, ‘Multifort’, and ‘RS-04-106’, while ‘Maxifort’ resulted in 1–2 galls per plant (rating = 1). Non-grafted and self-grafted ‘Florida-47’ plants showed significantly higher levels of infestation, i.e., 30–100 galls per plant (rating = 4). A follow-up field trial was carried out in the fall to test the field performance of grafted plants. ‘Tygress’ as the susceptible scion was grafted onto ‘Beaufort’. Interestingly, similar levels of root-knot nematode infestation were observed in grafted vs. non-grafted plants while grafting with ‘Beaufort’ significantly increased tomato yield. Further research is warranted to examine the resistance of vigorous rootstocks to difference root-knot nematode races under field conditions and possible presence of tolerance in some rootstocks.

Early-season Production of Summer Squash (*Cucurbita pepo*) in High Tunnels

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The goal of this study was to determine feasibility of early season summer squash (*Cucurbita pepo*) production in high tunnels. The objective was to evaluate the effectiveness of secondary row covers inside high tunnels. Summer squash were transplanted into high tunnels and grown 5 Mar. to 21 May 2010. Row covers (1.5-m height) were used only four nights in the season. Air temperatures were recorded outside and inside of the high tunnels, and then under the secondary row covers. The maximum, minimum and average air temperatures were higher inside the high tunnels by 20.64, 5.33, and 7.96 °F, respectively, compared with outside. The secondary row covers (Frost Blanket) increased the maximum, minimum, and average air temperatures inside row tunnels by 2.36, 4.89, and 2.53 °F, respectively, compared with air temperatures inside the tunnels. High tunnels added 44 more GDD₅₀, compared with outside environment. An additional 15 GDD₅₀ accumulated inside the row covers, during the 4 d they were used, compared with GDD₅₀ inside the high tunnels. For the complete crop cycle (5 Mar.–21 May 2010), there were no differences in the GDD accumulations in row tunnels; however, the GDD accumulation inside high tunnels was higher by 36% compared with accumulation outside.

Utilization of Grafted Tomato Seedlings for Bacterial Wilt Management in Open Field Production

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Seven tomato rootstocks claiming resistance to bacterial wilt (*Ralstonia solanacearum* L.) were used in combination with a single tomato scion to evaluate the performance of grafted seedlings in open field production. A self-grafted entry was included to ensure that the grafting process did not impact bacterial wilt resistance or fruit yield. Bacterial wilt incidence was variable between trials. The self-graft as well as the grafted entries had low incidence of bacterial wilt infection in one trial, while the self-graft and non-grafted entries had high incidence in two trials. Significant differences in bacterial wilt incidence were observed in all trials between resistant rootstocks and self- and non-grafted entries. Rootstock had a significant effect on total marketable yield in all trials with certain grafted entries yielding significantly greater than non-grafted 'BHN 602'. These data show that grafting holds promise for increasing the disease resistance in tomato cultivars as well as increasing the overall productivity of tomato cultivars.

Performance of Grafted Heirloom Tomatoes on 'Beaufort', 'Celebrity', and 'Maxifort' Rootstock

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An experiment was conducted in 2010 to evaluate three tomato rootstocks on performance of three heirloom and one commercial tomato cultivars. The rootstocks used were 'Maxifort', 'Beaufort', and 'Celebrity'. The heirloom cultivars were 'Cherokee Purple', 'Black Prince', and Brandywine', while the commercial cultivar was 'Celebrity'. Additional treatments consisted of no grafting and self-grafting for a total of 19 treatments. Photosynthesis was measured about 30 d after transplanting but no detectable differences were observed in any treatment. Weekly harvests, seven in total, were collected between 1 June and 15 July 2010. Harvest data included number and weight of culls, marketable fruits, and totals. 'Celebrity' outyielded other cultivars irrespective of rootstock. Results indicated that the commercial cultivar Celebrity didn't achieve any significant yield improvement when grafted to any heirloom variety. Results also indicated that grafting the heirloom cultivars Cherokee Purple and Black Prince on 'Celebrity' rootstock didn't result in significant yield improvement. On the other hand, grafting the heirloom 'Brandywine' on 'Celebrity' rootstock reduced total yield. The only significant yield increase was observed with grafted plants on 'Beaufort' rootstock over non-grafted plants.

Weed Control Options for Organically Grown Vine Crops

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Organic melon production requires effective weed management practices for achieving acceptable crop yield and quality. Research conducted in 2010 in southeastern Oklahoma (Lane) compared several possible weed management strategies for cantaloupe. Treatments included black plastic mulch, black woven landscape fabric, cultivation, flaming, Greenmatch herbicide as postemergence directed spray, corn gluten meal applied in a band along side of the row, and Matran herbicide as postemergence directed spray. Weeds present included smooth crabgrass [*Digitaria ischaemum* (Schreb.) Schreb. ex Muhl.], cutleaf groundcherry (*Physalis angulata* L.), piny amaranth (*Amaranthus spinosus* L.), and yellow nutsedge (*Cyperus esculentus* L.). At the three-leaf crop stage, vigor was assessed and weed populations determined. Yellow nutsedge populations were determined again 5 weeks later. Crop vigor was greatest in the mulch, landscape fabric, and corn gluten meal treatments (85% to 90%) and ranged from 68% to 80% for other treatments. The mulch and landscape fabric treatments reduced the populations of all weed species significantly. Melons were harvested 4 times over a 3-week period. Combined marketable yields across harvests ranged from 4500 to 8000 fruit per acre but did not differ across treatments. At the first harvest, yields were significantly greater in the mulch and fabric treatments, likely due to the soil warming effects of these treatments. Yields of largest melons (>6.5-inch diameter) were lowest in the mulch and landscape fabric treatments. In summary, mulch and landscape fabric treatments provided greatest weed prevention, best early crop vigor, and greatest early yields.

Nitrogen Management for Snap Beans on Sandy Loam Soils in the Mid-Atlantic

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Over 5400 acres of snap beans (*Phaseolus vulgaris*) are grown in Virginia per year within the environmentally sensitive Chesapeake Bay watershed. The objective of this study was to pinpoint correct nitrogen (N) rates and application timing for fertilizer sources containing varying amounts of ammonium, nitrate, or other N forms. The experiment was arranged as a factorial arrangement of 3 N rates (40, 80, and 120 lb N/acre) x 2 N application methods [100% preplant incorporated (PPI) and 50% at-planting PPI + 50% sidedress at mid-flower (SDM)] x 6 N sources [liquid urea-ammonium nitrate (UAN, 30% N), calcium nitrate (2009 only; CN, 17% N), ammonium nitrate (AN, 34% N), ammonium sulfate nitrate (ASN, 26% N), urea (2010 only; UR, 46% N) and UR + dicyandiamide nitrification inhibitor (UDCD, 46% N)] plus a 0-N control on a Bojac sandy

loam. The study was repeated in fall 2009 and 2010. In no case was an interaction significant at $P = 0.10$ and only main effects will be discussed. In 2009, fall treatments suggested that all N sources had statistically similar yields and were higher than the 0-N control (6703 vs. 4296 lb/acre, respectively). A quadratic relationship indicated that 80 lb N/acre was optimum for maximum yields (7200 lb/acre). In 2010, UDCD had higher yields than the control, UAN, AN, and ASN (2845, 3162, 2656, and 3100 lb/acre, respectively; $LSD_{0.10} = 306$ lb/acre). A quadratic relationship indicated that 40 lb N per acre produced optimal yields (3170 lb/acre). For application timing, PPI and SDM treatments were equal (3220 and 3284 lb/acre, respectively; $LSD = 193$ lb/acre). In conclusion, N source only mattered under non-ideal growing conditions where nitrification inhibition may have been beneficial, a rate of 40 to 80 lb N/acre should be used, and application timing did not matter.

Cultural Practices for Indeterminate Bell Pepper Production in Dominican Republic, Honduras, Nicaragua, Costa Rica, and El Salvador

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Bell pepper (*Capsicum annuum*) production in Central America and the Caribbean has become one of the main agricultural commodities for exporting into the US and the European Union. To guarantee constant supply and quality, small and medium-size growers use passively ventilated protective structures like greenhouse and high tunnels. The main goal of those structures is to controlling the growing environment, reduce pests, and improve fruit quality and yields. Nevertheless, small and medium-size growers cannot afford using electric or diesel fans and cooling systems to lower temperatures and relative humidity, which causes increased fruit sun-scalding, lowered fruit number and size, and thus increased postharvest losses (as high as 35% in some colored peppers). For this reason, two experiments were carried out at the Dominican Republic. The first study sought to determine the effects of planting densities and flower pruning programs on yield and postharvest quality in indeterminate bell pepper grown under protected environment. The distances were 20, 25, and 30 cm between plants combined with two

flower pruning programs: one flower per node (Dutch pruning), and no flower removal on each node (Spanish pruning). There was no interaction between both factors. Marketable and non-marketable fruit number and weight were the highest at 30 cm between plants, whereas the Dutch pruning showed the highest marketable fruit weight and number. For fruit quality traits, the combination of Dutch pruning and 25 cm between plants and the combination of Spanish pruning and 30 cm between plants resulted on the highest fruit weight, length, diameter, and thickness. The second study dealt with the effects of flower pruning and number of stems on yield and postharvest quality of indeterminate bell pepper under protected environment. Three pruning levels were used for this experiment: pruning up to the 10th, 15th, and 20th node in combination with one and two stems. The number of fruit, fruit yield, and number and weight of non-commercial fruit were the highest for plants with two stems. The combination of one stem and pruning either to the 10th or 15th node resulted on the highest fruit weight, length, diameter, and thickness.

Validation of Multiple Soilless Culture Practices under Protective Structures for Vegetable and Small Fruit Production

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Protected vegetable and small fruit production is widely used in Europe and other parts of the world. However, in Florida, open-field production remains as the main production system. Vegetable and small fruit production under protective structures could potentially increase yield, improve fruit quality, promote early ripening, reduce pest incidence and rain damage depending on the structure. The objective of the study is to characterize the response of determinate bell peppers (*Capsicum annuum*) grown under a greenhouse with different soilless media and container types in Florida. Plant growth, petiole NO_3-N concentration, and fruit earliness of pepper were measured. Twelve treatments were tested using four soilless media [pine bark, perlite, coconut coir, and potting mix (Fafard Mix 2)] and three container types (pots, box, and growing bags). The volumes per plant of each container were 7.5, 7.5, and 2.3 L/plant for pots, boxes, and growing bags, respectively. The results showed no interaction among factors for plant height and early yield. Pine bark, coconut coir, and potting mix had the tallest plants and the highest early yields. On container types, the boxes and pots had the tallest plants. There was no difference among container types on early yields. Interaction between the factors was found for petiole NO_3-N concentration. The treatments with the lowest values were perlite in pots and perlite in boxes (under NO_3-N sufficiency range), followed by perlite in bags and potting mix in bags. The low performance of perlite could be related to its low water retention. Pine bark is the cheapest medium and it is readily available in most areas.

Exogenous ABA Application Impacts Seedling Height and Survival in Bell Pepper

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Excessive internode elongation prior to field establishment can result in challenges for growers using mechanical transplanters to establish their crops. Controlling the height of vegetable transplants prior to planting is essential. A greenhouse experiment was conducted in 2008 and 2009 to determine the efficacy of exogenous drench-applied abscisic acid (ABA) applications for height control of transplanted pepper. Three types of pepper (*Capsicum annuum* L.) were investigated: bell pepper ('Aristotle'), jalapeño ('Grande'), and banana pepper ('Pageant'). Ten ABA treatments, based on application frequency and timing, and an untreated control were evaluated over an 8-week period each year. Early single-dose applications were more effective at controlling height than a single dose applied later. Multiple ABA applications initiated early (at the cotyledon stage) to 'Aristotle' bell peppers were effective in slowing transplant growth compared with any single ABA application. Differences among the response of pepper types to ABA application were observed. Follow-up studies involving two greenhouse experiments were conducted to determine phytotoxicity induced by exogenous drench application of ABA on bell pepper 'Aristotle' seedlings. Treatments were made up of combinations of ABA concentration and frequency applied over a 1- to 5-week period in addition to an untreated control. Plant survival for the control and the 1000 mg·L⁻¹ (baseline treatments) was significantly greater compared with the single application and multiple applications of greater concentrations. As ABA concentration increases the longevity of survival is decreased as demonstrated by a larger estimated hazard ratio when the concentration of ABA increases. Applying higher concentrations of ABA using multiple lower concentration applications resulted in lower hazard ratios and increased longevity compared with a single higher concentration application. Our study determined that ABA delivered as drench applications at the cotyledon stage can significantly control transplant height with no visible phytotoxicity.

Yield Performance, Quality, and Antioxidant Content of Sweetpotato in Response to Photoselective Mulch and Row Covers

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The present study was conducted to determine the influence of agricultural practice (photoselective plastic color mulch and spun-bonded row covers) on sweetpotato [*Ipomoea batatas* (L.) Lam. 'Beauregard'] yield, quality and antioxidant content. The study was conducted during Summer 2008, at Auburn University's E.V. Smith Research and Extension Station located in Shorter, AL. The experiment consisted of 12 treatments: 1) black plastic mulch plus spun-bonded row cover (BPM+RC); 2) black plastic mulch (BPM); 3) red plastic mulch plus spun-bonded row cover (RPM+RC); 4) red plastic mulch (RPM); 5) bare soil plus spun-bonded row cover (BS+RC); 6) bare soil (BS); 7) silver plastic mulch plus spun-bonded row cover (SPM+RC); 8) silver plastic mulch (SPM); 9) white plastic mulch plus spun-bonded row cover (WPM+RC); 10) white plastic mulch (WPM); 11) blue plastic mulch plus spun-bonded row cover (BLUPM+RC); and 12) blue plastic mulch (BLUPM). Yield components (U.S. #1, total marketable yield, total yield, vine length, vine weight, above and below mulch temperature, and total soluble sugar content) and antioxidant content [total carotenoid (TC) vitamin C and total phenolic content (TP)] were determined. Our findings indicate the following: 1) the use of plasticulture on sweetpotato has potential benefits in modifying growth and nutritional status of sweetpotato grown in central Alabama; 2) spun-bonded row covers enhanced air temperatures; 3) dark-colored plastic mulches increased soil temperatures compared to lighter-colored plastic mulches; and 4) silver plastic mulch and row cover and red plastic mulch treatments had higher earlier, marketable and total yields when compared to other treatments. Further investigations are required to determine the exact mechanisms involved in order to fully exploit this technology (plasticulture) intended to enhance early market season, quality, and nutrition of sweetpotato.

Soil Nitrogen, Leaf Nitrogen, and Fruit Yield in Bell Pepper (*Capsicum annuum* L.) as Affected by Fertilization with a Slow-release Nitrogen Fertilizer

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Slow-release fertilizers are a possible alternative to increase nitrogen use efficiency in vegetable production. The objective of this study was to evaluate the effect of a slow-release nitrogen fertilizer (SRF) on the levels of NH₄ and NO₃ in the soil, leaf N concentration, and yield of bell pepper ('Heritage') plants. The experiment was conducted at the Horticulture Farm, Tifton Campus, University of Georgia, during Spring 2008. The design was a randomized complete block with a factorial arrangement. There were four treatments [2 N fertilizers x 2 rates (200 kg/ha N and 280 kg/ha N)] and four replications. The N fertilizers were: SRF (Nitamin Nfusion, Georgia Pacific; 22 N-0 P₂O₅-0 K₂O) and calcium nitrate as the control. At about midseason,

47 d after transplanting (DAT), the concentrations of $\text{NH}_4\text{-N}$ and $\text{NO}_3\text{-N}$ at both 30-cm and 60-cm soil depth were higher in soils fertilized with SRF than those fertilized with calcium nitrate. No differences in concentrations were found, however, 69 DAT and 100 DAT. Leaf N concentrations 40 DAT and 68 DAT were higher in plants fertilized with SRF compared to the control, while there were no differences in leaf N concentration 98 DAT. Regardless of the N fertilizer, concentrations of $\text{NH}_4\text{-N}$ and $\text{NO}_3\text{-N}$ in the soil and leaf N concentration were higher at higher rate of N fertilization. There was a fertilizer x rate interaction for marketable and total yields. Marketable and total yields were highest with calcium nitrate at 280 kg/ha and SRF at 200 kg/ha and lowest with SRF at 280 kg/ha. Marketable and total yields were not significantly affected by rate of calcium nitrate but decreased with increasing rates of SRF. Fertilizer and rate did not affect the weight of individual fruit.

What Is Earth-Kind Vegetable Production?

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An experiment was conducted in 2010 to evaluate whether the principles of “Earth-Kind” roses production is applicable to nine vegetable crops, namely ‘Spineless Beauty’ zucchini, ‘Spacemaster’ cucumber, ‘Juliet’ tomato, ‘Celebrity’ tomato, ‘Ichiban’ eggplant, ‘Sweet Banana’ pepper, bell pepper, sweet corn, and ‘Henderson Bush’ beans. The objective of Earth-Kind vegetable production is to encourage water conservation, reduction of fertilizer and pesticide use, energy conservation, and reduction of wastes. Nine commercial vegetable cultivars and three replications were grown in mushroom compost (MC) or city compost (CC). Compost was incorporated preplant, and mulch was added on all plots. A onetime preplant application of 50 lb N fertilizer was added to CC plots, in order to bring soil fertility to levels similar to those in the MC plots. No additional fertilizer was applied during the duration of the trial. Drip irrigation was supplied on a regular basis to the equivalent of 1 inch of water per week. One application each of Neem and Pyrethrin (organic fungicides) and of Bravo (synthetic fungicide) was applied before harvest began. Initial results indicate that successful Earth-Kind vegetable production can be achieved with ‘Juliet’ tomato, banana pepper, and beans. Crops not suitable to be grown following Earth-Kind principles include ‘Celebrity’ tomato, bell pepper, eggplant, and cucumber. This study also indicated that mushroom compost is best suited for Earth-Kind vegetable production, which achieved higher yields than city compost plots without any additional N fertilizer.

Effects of Melon Grafting on Scion Compatibility

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The goal of this study was to determine the effect of grafted melons on plant vigor, fruit internal quality, and overall market-

able yields. Grafted plants were evaluated in Spring 2010, at the Coastal Research and Education Center of Clemson University, Charleston, SC. Rootstocks used were: TZ 148 (wild melon hybrid), Kazako (interspecific squash hybrid) Carnivor (interspecific squash hybrid), and Tetsukabuto (interspecific squash hybrid). The scion material consisted of cultivar Athena, Home Run, ACX 428 ES, and Fantasista. In addition, all cultivars were self-grafted. All grafting was done using the one cotyledon graft. All plots were 40 ft long, 2 ft between plants, with 9 ft between rows, replicated four times. Fruit was harvested at full slip and categorized as marketable if they weighed above 4 lb. Fruit were graded according to the US Department of Agriculture (USDA) grading standards for all melon fruit. Overall grafting increased the average fruit size, and decreased the size of the internal cavity. Grafting affected the fruit shape by making it more circular rather than oval. Sugars were unaffected. Yields in general increase with grafting on all cultivars. The first harvest saw the greatest benefit to grafting with a significant increase in fruit number harvested. However, with the cultivar Fantasista when grafted upon rootstock Kazako showed signs of incompatibility at fruiting. Plant death occurred once the crown fruit set. Further studies in the coming year will be done to confirm this information.

Evaluating the Sole Usage of Biorational Pesticides for Pest Management on Vegetables

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Crop pest management must take into consideration farmer safety, sustainability of methods, likelihood of adoption, and potential food safety risks especially among small vegetable growers. This report provides preliminary findings on the challenges of using exclusively OMRI-listed biorational pesticides in the management of pests on some specialty vegetables. We applied five commercially available biorational insecticides (Agroneem[®], Trilogy[®], Neemix[®], Mycotrol-O[®], and Monterey[®]) and a neonicotinoid insecticide (Provado[®]) at the manufacturers’ recommended rates in 10-d spray cycle on vegetables in small field plots during July and Oct. 2010. Data collected on insect population fluctuation, plant damage, and yield suggest crop-specific variations in insecticide performance among the tested insecticides. The pest arthropod species recorded included *Empoasca* sp., *Halyomorpha halys*, *Leptoglossus* spp., *Acrosternum hilare*, *Heliothis* sp., *Melanoplus* spp., *Diabrotica undecimpunctata* (on *Vigna unguiculata* and *Cajanus cajan*), *Lygus* sp., *Heliothis* sp., *Disonycha glabrata*, *Diabrotica* sp., *Spodoptera* spp. (on *Amaranthus* sp.), *Leptinotarsa decemlineata*, *Tetranychus* sp., *Heliothis* sp., *Spodoptera* spp., *Gargaphia solani*, *Aphis* sp. (on *Solanum melongena*). Beneficial species such as *Harmonia axyridis*, *Perillus bioculatus* and *Collops* genus were also recorded. None of the insecticides successfully suppressed insect pests across the spectrum and none prevented damage on Amaranth

when used in a 10-d spray cycle. Agroneem[®], Trilogy[®] and Neemix[®], which contain similar active ingredients (azadirachtin and other neem compounds), performed differently. Monterey[®], which contains spinosad, was the best in controlling leaf chewing beetles and caterpillars on eggplant. Provado[®] (active ingredient imidacloprid) stimulated mite reproduction and with somewhat inconclusive results regarding its impact on natural enemies. We conclude that the sole dependence on a single biorational insecticide by small growers is unsustainable and ill-advised. We propose combining biorational insecticides having different modes of action, or alternating them with low-risk insecticides and used with resistant cultivars and natural enemy enhancements where possible and in adherence to a scouting-driven demand.

Crop Strategies for Globe Artichoke in Texas

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Globe artichoke [*Cynara cardunculus* L. var. *scolymus* L. (Fiori)] is a high-income crop. The heads are rich in phenolic compounds, which are known to have antioxidant properties, beneficial to human health. For Texas agriculture, artichoke could be a new alternative specialty crop and, therefore, cultural strategies must be developed for our environment. Studies were conducted on transplant stress tolerance to improve stand establishment and on selective depredation of transplants by white-tailed deer. Further experiments investigated irrigation and nitrogen (N) application rates to enhance yield and nutritional quality of heads, and on gibberellic acid and plasticulture to induce earliness, improve yield and extend the harvest season. In addition we screened several cultivars for adaptability to the region. Drought and high temperatures during summer planting can affect growth, survival and field establishment. Transplant studies showed that abscisic acid (ABA) was an effective plant growth regulator to control leaf transpiration and increase leaf water potential of young transplants. Furthermore, feeding trials with captive white-tailed deer determined that deer consistently preferred to eat the most mature transplant foliage offered. Field experiments on irrigation and N management revealed that irrigation was more effective than N application to optimize yield. In terms of cultivars, best marketable yields were found for 'Green Globe Improved', followed by 'Concerto', 'Madrigal', 'Imperial Star', and 'Lorca'. By integrating results from these experiments, crop guidelines for annual artichoke production were established and are being introduced to small growers in Texas.

Food Quality and Safety of Fresh-cut Sweetpotatoes (*Ipomoea batatas*)

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Sweetpotatoes are highly nutritious vegetables. However, they are only marketed on a very limited scale. Recently, the market has had an increased demand for pre-cut/fresh-cut fruits and vegetables due to fresh-like character, convenience, and health benefits. Fresh-cut produce is a perishable commodity with a shorter postharvest shelf-life, and needs better and safer post-harvest quality maintenance. The objective of this study was focused on the effect of sanitizers and antioxidants on color, polyphenoloxidase (PPO), headspace gas composition (O₂ and CO₂), and bacterial counts. Trisodium phosphate (4%), sodium hypochlorite (1000 ppm), and Tsunami 200 were used as sanitizers. Sliced sweetpotatoes from two cultivars ('Beauregard' and 'Covington') were treated with sanitizers and packed in high-O₂ permeable bags and low-O₂ permeable bags flushed with gas composed of 4% O₂, 10% CO₂, 86% N₂, respectively. The sweetpotatoes were stored at 5 °C and analyzed every 4 d for up to 20 d. The surface color (L, a, and b values) of sliced sweetpotatoes was measured. PPO activity was assayed to determine enzymatic darkening of sweetpotatoes during storage. Headspace gas composition of O₂ and CO₂ was determined in the bags containing sliced sweetpotatoes. Total plate counts and yeast and mold counts were analyzed for shelf-life. The application of different sanitizers is necessary to maintain microbial quality and safety of fresh-cut produce during storage prior to reaching the consumers.

Vegetable Crops Section—Cowpea

Potential of Cowpea as a Health-promoting Food to Prevent Chronic Disease

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Grain pulses are increasingly recognized for their health benefits and potential to help alleviate chronic nutrition-related diseases. Unfortunately, current consumption of grain pulses in the US is less than one-sixth of the recommended daily intake. There is tremendous opportunity to expand grain pulse consumption by diversifying product offerings beyond the common beans. Cowpea (southernpea) is an excellent candidate due to its good agronomic properties, versatility, and nutritional profile. However, information on health benefits of cowpea is lacking; this is essential to effectively promote the crop for widespread food use. Our research is aimed at identifying cowpea varieties with the best potential to promote human health and documenting how their consumption impacts human health. From screening a diverse set of germplasm, cowpea varieties with a smooth seedcoat had higher levels of phenols, antioxidants, and other health-promoting compounds than those with a rough seedcoat. This is attributed to the fact that smooth-seeded cowpea varieties have a higher proportion of seedcoat, where most of the bioactive compounds are located. Based on seedcoat color, the light

brown varieties had the highest phenol content and antioxidant activity, followed closely by black and red varieties. On the other hand, white-colored varieties had the lowest level of phenols and antioxidant activity. For example, ORAC values averaged 32 $\mu\text{mol TE/g}$ in white and 207 $\mu\text{mol TE/g}$ in light brown phenotypes. Boiling to a soft texture produced a modest (0 to 20%) reduction in antioxidant properties of most cowpea varieties, indicating health benefits are likely retained after processing. Preliminary evidence further indicates that high antioxidant cowpea varieties also show significant anti-inflammatory activity in human cell models. Cowpea is promising as a health-promoting dietary component; future studies will investigate specific health outcomes associated with the light brown, red, and black varieties.

Resolving the Impasse in the Use of Plant Oils in Cowpea Postharvest Pest Control—A Progress Report

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Postharvest losses in cowpea (*Vigna unguiculata* Walp.) can be in excess of 60% especially where no insecticide protection is provided. The bruchid *Callosobruchus maculatus* (F.) accounts for most of the losses worldwide. The use of high-risk synthetic insecticides such as Actellic Super® [pirimiphos-methyl (1.6%) + permethrin dust (0.3%)], which is the standard product in many tropical countries, poses increasing food safety concerns to unsuspecting consumers and producers. To counteract this trend, several low-risk, biorational plant-derived products have been evaluated but interest in these has never been sustained to commercialization. One such product is vegetable oil. In this report we present preliminary findings on a study using six plant oils (canola, garlic, peanut, coconut, sunflower, and truffle) purchased from local supermarkets in Greensboro, NC, and tested against the cowpea weevil on two cowpea varieties, 'Mississippi Silver' (MS) and 'Pinkeye Purple Hull' (PPH). For each variety, 4 g of seed were treated with 15, 20, 25, and 30 μL of oil (representing a rate of 3.7–7.5 mL/kg) and infested with 10 unsexed 2- to 3-d-old adult insects. Oil was thinly applied on test seeds before infestation with adults. Cumulative adult mortality increased with oil dose reaching 100% after 2 d on MS with 30 μL . Oviposition was reduced by over 95% in some cases, and no adults emerged in most treatments. Truffle and sunflower oils were very effective; insects on MS seeds treated with garlic, canola, and truffle (20 μL), truffle (25 μL) and truffle, sunflower, and coconut (30 μL) were all dead 2, 4, and 3 d, respectively, after treatment. PPH seeds treated with coconut, sunflower, and truffle had the least number of eggs laid on them. There was a clear kairomonal effect in truffle and sunflower oils where attraction peaked after 1 h in the 30- μL treatment. Clearly, vegetable oils can be used as safer, relatively inexpensive substitutes for currently used pesticides and other

storage protection practices used for cowpeas. Ongoing research will address several other issues related to the use of oils in storage of cowpeas.

The Emergence of Cowpea as a Major Food Legume in the 21st Century

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Cowpea [*Vigna unguiculata* (L.) Walp.] is emerging as one of the most important food legumes in the tropics and subtropics in the 21st century. This is because most of the improved cowpea varieties mature between 60 and 70 d and fit well as a niche crop in the existing cereal and root crop-based cropping systems, whereas other food legumes like chickpea, lentils, pigeon pea, field pea, and beans mature in 120 d or more and compete with cereals for land, which makes it less likely for these crops to occupy additional area in future. Also, there is a greater opportunity to increase cowpea yields by improved plant type and multiple pest resistance compared to other pulses. Cowpea is well integrated in the local cropping and food systems in over 65 countries and the annual world cowpea production has increased from about 0.87 million tons in 1961 to over 6.3 million tons in 2009. The increase in the last decade alone, from 2001 to 2009, was 73% for cowpea compared to an average increase of only 10% for all the pulses. In the wake of increasing global warming, declining rainfall and increased drought and fertilizer prices, it is expected that cowpea production will increase manifold in future when improved "60-d cowpeas" with tolerance to heat, drought and low-P with 30% protein, high iron, zinc, antioxidants and other health factors become available and grown as a niche crop in the cereals and root crops systems covering millions of hectares in Asia, Africa, southern USA and Brazil. Also, the availability of Maruca-resistant "Bt-cowpeas" would bring a surge in cowpea productivity within the next 10 to 15 years in Africa and parts of Asia where Maruca pod borer is a major pest. The increased cowpea production would find easy markets as a health food in the developed countries and as a staple source of dietary protein for the masses in Asia, Africa, and South America where pulses are widely consumed but their production is not keeping pace with population growth.

Vegetable Crops Section—Watermelon

Irrigation Levels Effects on Fruit Yield and Quality of Seedless Watermelon (*Citrullus lanatus* Thunb.)

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Watermelon is an important vegetable in the southeastern U.S. The efficient use of water is a pressing need due to the occurrence of droughts and the high cost of energy used for irrigation. The combination of plastic film mulch and drip irrigation has the potential to optimize irrigation water use efficiency. Over irrigation may also be conducive to increased incidences of plant diseases such as phytophthora blight. In this study we evaluated the effects of irrigation rates on fruit yield and quality in watermelon. The study was carried out in the spring season of 2009 in Camilla, GA (loamy sand soil) and Tifton, GA (sandy loam soil). The experimental design was a randomized complete block with five irrigation rate treatments [33%, 67%, 100%, 133%, and 167% the rate of crop evapotranspiration (ETc), adjusted by the crop factor] and four replications. Seedless watermelon plants ('SSX-7401' as female, and '8662' as the pollenizer) were grown on raised beds (1.8 m from bed center to center), with black plastic mulch and drip irrigation. Fruit yields and the average fruit weight were higher in Tifton than in Camilla, although the percentage of marketable fruit was higher in Camilla than in Tifton. Fruit yields and average fruit weight were not significantly affected by irrigation rate; however, they tended to be lowest at the lowest irrigation rate (33% ETc). Fruit flesh pH was lowest and TSS was highest at the lowest irrigation rate. The pH and acidity were not significantly affected by irrigation rate, although pH tended to increase and acidity to decrease with irrigation rate. The TSS was highest (10.3%) at 33% ETc and lowest (9.4%) at 166% ETc. In conclusion, there is potential to reduce the current rates of watermelon irrigation and thus increase the water use efficiency without significantly affecting fruit marketable yields and quality. Fruit yield and quality of watermelon plants irrigated with 67% ET were similar to those of plants irrigated at higher irrigation rates.

Tolerance to Phytophthora Fruit Rot in Watermelon Plant Introductions

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Phytophthora capsici is distributed worldwide, and is an aggressive pathogen with a broad host range infecting solanaceous, leguminaceous, and cucurbitaceous crops. Fruit rot, caused by *P. capsici* is an emerging disease in most watermelon producing regions of the southeastern US. Resistance to fruit rot of watermelon is sorely needed to manage *P. capsici*. Evaluations to identify sources of resistance have not been conducted before. Plants belonging to the core collection of watermelon plant introductions (PI; www.ars-grin.gov) were grown in a field on raised plastic beds in Charleston, SC, in 2009. Five fruits from each PI were harvested when the tendrils next to the fruit were dry. Harvested fruit were placed on wire shelves and inoculated with a 7-mm plug from an actively growing colony of a SC isolate of *P. capsici* on V-8 juice agar. The shelves were kept in an enclosed room where high relative humidity (>95% RH) was maintained. Four days after inoculation, data on length of disease lesion and intensity of sporulation were recorded for each fruit.

Of the 205 PI evaluated, the majority were highly susceptible and extensive sporulation was observed on most fruit. Overall we identified 25 PI (12%) as potential sources of resistance. Twenty-two (12%) of the 159 *Citrullus lanatus* var. *lanatus* PI we evaluated from the core collection, one *C. colocynthis* (PI 388770) and two *C. lanatus* var. *citroides* PI (PI 189225) showed tolerance to fruit rot. We also observed variability in the resistant reaction to fruit rot within these PI, indicating the need for further screening and selections. The most tolerant PI were re-evaluated in 2010. Fruit from PI that were tolerant had significantly lower amounts of *P. capsici* DNA/g of fruit tissue compared to susceptible commercial cultivars Sugar Baby and Black Diamond. Selections from the most tolerant PI will be further evaluated using different isolates of *P. capsici* to confirm the stability of resistance.

Results of 2010 Fungicide Trials to Manage Phytophthora Fruit Rot of Watermelon in South Carolina

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Fruit rot, caused by *Phytophthora capsici*, is an emerging disease in most watermelon producing regions of the southeastern US. The National Watermelon Association (NWA) has considered this disease as a top research priority because of losses incurred by the growers in North Carolina, South Carolina, and Georgia. For the past several years we have been conducting trials to identify effective fungicides to manage fruit rot of watermelon. Based on 3 years of field testing (2006–08) under severe disease pressure, we identified two relatively new fungicides, Revus and Presidio, that are labeled for use on cucurbits. In field trials conducted in 2010, the rotation of Presidio and Revus was the best treatment and significantly reduced fruit rot compared to non-treated control. Application of the systemic resistance activator (SAR) Actigard every week for 5 weeks also significantly reduced fruit rot. Forum, Zampro, Prophyt + Kocide, and Revus rotated with Prophyt + Kocide treatments also significantly reduced fruit rot compared to non-treated control in the field. Ridomil Gold, the standard treatment was not significantly different from the non-treated control as expected, because mefenoxam insensitive strains were present in the field. Symptomless fruit harvested 4 d after the last spray application were inoculated and maintained in a humid chamber that favored fruit rot development. The development of disease lesions and sporulation on fruit treated with fungicides Zampro, Forum, and rotation of Presidio with Revus in the humid chamber were significantly less compared to the non-treated control. Resistance in the pathogen population to fungicides such as Ridomil Gold and Ranman has been identified previously. Thus, there is always a possibility of *P. capsici* developing resistance to the above-mentioned fungicides. Therefore these fungicides should be rotated or tank mixed with other available fungicides to prolong their usefulness in managing fruit rot.

Field Survey of Pollenizer Flowering, Triploid Fruit Set, and Pollinator Activity in Delaware Watermelons

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An on-farm pollination survey was conducted in Delaware watermelon fields in 2010 to assess pollination. Twenty watermelon fields representing 14 cooperating growers were surveyed from the third week in June through the second week in August. Data were collected weekly on male flower counts, fruit set, stem number and length, vigor, and health for triploids and pollenizers. Bee counts were bi-weekly. Crown set did not differ significantly by pollenizer or triploid; however, there was a significant trend toward reduced early set with reduced pollenizer or triploid vigor. In-row standard diploid pollination systems had significantly earlier crown set than in-row special pollenizer or separate row systems. Fruit numbers varied significantly with pollenizer but not triploid. Mean fruit numbers ranged between 2.0 and 2.7 per plant. There was a linear reduction in fruit numbers ($R^2 = 0.25$) with reduced triploid vigor. Reductions in pollenizer vigor, male flower counts, or pollenizer vine length also reduced fruit numbers; however, adding these factors only explained an additional 2% of the variability. There were no differences in mean fruit numbers between bumble bee and honey bee pollinators. However, there were differences between varieties in triploid fruit set and crown set with bumble bees.

QTL Mapping of Important Horticultural Traits in Watermelon

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Three mapping populations were developed for mapping horticulturally important traits in watermelon (*Citrullus lanatus* Thunb.). These populations were crosses between two elite cultivars ('Klondike Black Seeded' × 'New Hampshire Midget'), an elite cultivar and wild egusi accession (Strain II × PI 560023) and an elite cultivar and a wild citron accession (ZWRM50 × PI 244019). Single nucleotide polymorphism (SNP) maps were constructed and compared. The elite × egusi and elite × citron F_2 populations consisted of 187 and 182 individuals respectively while the elite × elite recombinant inbred line population (RIL) consisted of 163 lines. Phenotypic data were collected and analyzed for quantitative trait loci (QTL) for several important traits

including fruit weight, fruit length, fruit diameter, thickness of the rind, Brix, presence of hollow heart, degree of fruit furrowing, seed weight and size, egusi seed type, seed oil percentage, percent aborted pollen, flower sex type and the number of days from sowing to the first female flower. More than 60 QTL associated with these traits were identified in these populations. These resources will be useful in future efforts to use markers assisted selection in watermelon cultivar improvement.

Watermelon Fruit Quality Study 2010

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It is believed that fruits from grafted watermelon plants have a firmer flesh, with slower drip loss and better color and sugar retention. These qualities would theoretically expand the shelf-life in the field and also improve postharvest market life. Field trials were conducted at Clemson University CREC in Charleston, SC. Two rootstocks: interspecific squash and a bottle gourd and one scion: TriX 313 (a seedless watermelon) were used for this trial. Three harvests were done when the fruit was deemed ready for harvest, 1 week later, 2 weeks later. The fruit will be determined ready by the dead tendril, as well as the death of the small leaf. Yield characteristics will be taken such as weight, Brix readings, and firmness readings. Ten fruit will be harvested from each rootstock and each of the harvest times. Fruit was held at 5 °C overnight, washed in a 100 ppm chlorine solution, and cut under aseptic conditions. Fruit deemed fully ripe (soluble solids content >10% and red in color (not pink or orange) will be sampled for fresh-cut storage. A slice cut transversely from each fruit, about 1 inch thick, will then be cut in quarters, keeping rind intact and location of ground spot known. Each piece was then cut into quarters. The quarter opposite the ground spot, and the quarter with a ground spot, will be placed in individual unvented sterile clamshells on a plastic grid, weighed, and placed at 5 °C (41 °F). Remaining quarters will be frozen at -80 °C. The remaining watermelon were tested for firmness in the heart area and rind thickness determined at four points corresponding to sample removal. After 5–7 d, stored quarters will be weighed and fruit rated for appearance of decay, pitting, water soaking, and color fading. The fruit was removed and drip loss determined by weight difference. Fruit quarters will be measured for rind thickness at the maximum arc of the piece. Flesh will be removed from the rind; both flesh and rind will be placed at -80 °C. Drip loss extracts will be collected by sterile pipets into sterile tubes for culture for bacteria and molds, and a portion immediately sampled for soluble solids content. All frozen flesh was analyzed at the North Carolina research campus by Dr. Perkins-Veazie for the amount of lycopene present, as well as soluble solids and acidity. The results indicated that the field harvest window can be expanded as well as the quality of watermelons improved with grafted plants.

Poster Section

Science-based Experiential Learning in the Greenhouse for Special Needs Students: Linking Secondary and Higher Education Institutions

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Horticulture therapy has been demonstrated to successfully enhance learning in many educational settings. Specifically, horticulture therapy has been integrated into curriculum aimed at teaching special needs students useful skills and knowledge. This paper describes a cooperative effort between a high school special education department and a plant and soil science program at the university level. Through addressing concepts and skills including problem solving, social skills, mental and muscular skills, and self-awareness, both the secondary and higher education units have benefited. This integration of horticulture therapy and service learning has produced initial positive results in all involved parties. This cooperation is being further developed to include resources for family members to participate with the student's activities and aiding in the post-graduation transition. Although still in the early stages of development, we are encouraged by what has been achieved, and plan on continuing to build upon this success with the motto; "don't focus on where we are ... look at where we are going."

Influence of Spacing on Production for Two Sorrel (*Hibiscus sabdariffa*) Varieties

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Hibiscus sabdariffa, also known as sorrel in the Virgin Islands, is an annual plant that is grown mainly for its colorful fleshy calyces during the Christmas season. Sorrel is used to make a healthy drink high in vitamin C and anthocyanins that is claimed to be better than cranberry juice. Sorrel is normally planted at 60 cm during July and August. The objective of this study was to compare sorrel growth and production of a Caribbean day-neutral variety and a Zambian short-day variety planted in September with in-row plant spacing of 20, 40, and 60 cm and 150 cm between rows. Data were collected weekly on plant height, branching, and fruit set. The results indicated that the day-neutral variety can be grown at 20–60 cm with no effect on branching or production. However, day-neutral plants are shorter at 60-cm spacing than either 20 or 40 cm while spacing was not an influence on plant height for the short-day variety at 20–60 cm. Short-day sorrel has greater branching and fruit set as the plant spacing increases from 20 to 60 cm. Planting sorrel in September at 40 cm can increase production per length of row.

Seed Source Location and Captan Influence Germination Behavior in *Rhododendron calendulaceum*

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Rhododendron calendulaceum, a species native to the eastern US, has a high degree of horticultural value. In the wild, this species has a considerable amount of inter- and intra-population variation in morphological and physiological characteristics. These inherent differences suggest that variations in germination behavior may exist in wild collected seeds. Furthermore, wild collected seeds are often prone to fungal contamination in their germination environment. Our objectives were two-fold: 1) to test for variation in germination behavior among seed lots, and 2) to investigate the effects of captan on the germination of *R. calendulaceum*. Significant differences in germination percentages existed between collections, with values ranging from 39% to 74%. Germination characteristics were evaluated in three separate collections of *R. calendulaceum* seeds in the absence or presence of captan at concentrations from 0.0 to 3.6 g/L. Germination was recorded daily. Significant differences in germination percentages (39% to 74%) existed among collections. Captan prevented fungal growth at levels of 0.9 g/L and higher. Though there was a trend for decreases in seed germination percentages as captan concentrations increased, it was statistically nonsignificant. However, the onset of germination was shown to be delayed by the use of captan, with T1 values ranging from 9.2 d without captan to 11.2 d with 3.6 g/L of captan. The rate and uniformity of seed germination was largely unaffected by captan, evidenced by the lack of trends in the T50 and T10-90 values. Based on our findings, we would recommend that propagators of *R. calendulaceum* use captan during germination as the demonstrated reduction in fungal contamination outweighs the negative effects of captan on germination.

Efficacy of Biofungicides for Control of Pythium Root Rot in Poinsettia (*Euphorbia pulcherrima* Wild. ex Klotzsch)

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Pythium stem and root rot is considered the most consistent and serious soilborne disease problem in poinsettia production. Greenhouse management practices typically include a fungicide drench (Subdue Maxx) when cuttings are transplanted. As a standard conventional fungicide, mefenoxam (metalaxyl) (Subdue Maxx) is a high-risk fungicide for resistance. A key component of resistance management is integrating biofungicides into a disease management program. The effect of biofungicides for control

of pythium root rot in poinsettia was studied. Each poinsettia plant was inoculated with 0.007 oz of pythium-infested rice. Most treatments were applied by drenching when plants were transplanted: biofungicide BW 240 (experimental) at 8 oz and 12 oz/100 gal water; RootShield (*Trichoerma harzianum*) at 4 oz/100 gal water; RootMate (*T. virens*) at 4 oz/100 gal water; Subdue Maxx (mefenoxam) at 1 fl oz/100 gal water; BW 240 fb and RootMate at 8.0 fl oz fb 4.0 oz/100 gal water and 12.0 oz/ fb 4.0 oz/100 gal water; BW 240 fb and Magellan at 8.0 oz/ fb 6.0 oz/100 gal water; BW 240 + Subdue Maxx at 8.0 oz/ + 0.5 oz/100 gal water. Magellan (phosphorous acid) was applied on a 14-d interval by drenching at 12 fl oz/100 gal water and by foliar application at 4 pt/100 gal water. Plants were arranged in a randomized complete-block design. Weekly visual rating, growth index, root health, and final shoot weight were measured. In the first summer trial 2010, the experimental biofungicide, BW 240 followed by RootMate, exhibited a level of numerically improved shoot vigor at all rating dates, fresh weight, and area under the disease progress curve (AUDPC) compared to the pythium-infested treatment. The phosphonates Magellan and Aliette also provided significant pythium control, resulting in acceptable plant vigor and reduced AUDPC. In the following fall trial, BW 240 tank-mixed with Subdue Maxx (0.5 fl oz/100 gal water) provided very good control, as well as Subdue Maxx (1.0 fl oz) and the non-inoculated control. Additional studies are warranted to further evaluate application rates, intervals, rotations, and tank-mixes of biofungicides and conventional products that control pythium stem and root rot.

Assessing Variation in Vegetative and Floral Morphology of Four Native Gulf Coast Species for Use as Ornamental Groundcovers

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Evaluating native plant species for vegetative and floral variation is necessary to accommodate the growing demand for native, noninvasive plants for built environments. Accessions of *Borrichia frutescens* (L.) DC., *Erigeron procumbens* (Hout. ex Mill.) G.L. Nesom., *Oenothera drummondii* Hook., and *Sesuvium portulacastrum* (L.), all woody or herbaceous perennial native species, were collected along the Texas coast to represent a geographic north-south gradient. Each species was grown at a common site to test for variation of flower number, flower diameter, plant size, foliage color, leaf shape, internode length, internode diameter, and growth habit. Morphological differences were found among accessions in dry masses, leaf shape, overall growth habit, and various ornamental traits. These findings suggest that there is statistically significant variation in vegetative and floral morphology among accessions within all four genera and provides a base for future selection of improved landscape cultivars from among these species. Greatest variation in ornamental traits was found with *B. frutescens* and *O. drummondii*.

Evening Primrose Yield Response to Harvest Aids

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Evening primrose (*Oenothera biennis*) is a wildflower currently grown for ornamental and medicinal purposes. The gamma linolenic acid (GLA) found in the seed is the herb's active ingredient. GLA has been shown to reduce cholesterol, help treat autoimmune diseases, and reduce the side effects of eczema. Currently, this crop is grown primarily in China and in the northern United States and Canada where the climates are cool and moist. *Oenothera elata*, the trumpet evening primrose, has a similar oil profile to *O. biennis* but is adapted to a more hot and arid environment. *Oenothera biennis* is primarily hand harvested to prevent shattering given its indeterminate growth habit, increasing the cost and keeping it from being more widely grown. Little research has been done to see if this crop has potential to be machine harvested. This study focused on comparing crop defoliant to a water control to see if harvest aids could remove foliage from *O. elata* without reducing yield. Paraquat, ethephon, and a mixture of Finish and Genstar defoliant were sprayed on the crop in October of 2009 and 2010. Two weeks after application, the crop was hand harvested and yields were compared to the control. There were no differences in yield when comparing the control to the harvest aid treatments in either year. The harvest aids removed the foliage and opened the pods slightly. These data suggest growers may be able to use select harvest aids in the future to be able to machine harvest *O. elata* without decreasing yields, allowing evening primrose production to increase.

The Effects of Irrigation Treatments on Stomatal Conductance in *Olea europaea* L.

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Irrigation is a financially limiting factor for Texas olive orchards. Our research objective was to measure the effects of high, medium, and low irrigation treatments on gas exchange, growth, and production of established 'Arbequina' olive trees at three different olive orchards in Texas: Texas Olive Ranch in Carrizo Springs, Conly Olive Orchard in Asherton, and Central Texas Olive Ranch in Walburg. The experiment was a randomized complete-block design with three blocks consisting of seven trees in each block. Each block was randomly assigned an irrigation treatment of high, medium, or low in May 2010. During the 2010 growing season, mid-day stomatal conductance was collected monthly. Trunk caliper and shoot growth was measured on each tree. In Sept. 2010, one hundred olives were collected from each tree at Texas Olive Ranch. They were then weighed and measured to see if fruit density differed among irrigation treatments. Gas exchange and growth data were exposed to

ANOVA appropriate for a randomized complete-block design. When significant treatment differences were observed, means were separated by Fisher's least significance procedure (SAS). Stomatal conductance data from each orchard indicated a similar trend that there was little difference between the three irrigation levels, and trees exposed to low irrigation rates compared favorably with trees exposed to medium and high rates. Mean individual fruit mass and volume tended to be greater for trees that received less irrigation, while overall mean fruit density was greatest for trees that received the high irrigation treatment. Tree physiology, plant growth, and fruit production were generally not affected by irrigation treatments, indicating growers may adjust their irrigation rates and conserve their limited water resources without reducing yield. Response of fruit and oil quality to irrigation treatments was not investigated, but would be a critical characteristic for future research.

Comparison of Organic and Inorganic Fertilizers on the Growth and Development of Containerized *Rosa hybrida* 'Radtko' and *Hibiscus rosa-sinensis* 'Evangeline'

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The effects of organic vs. inorganic fertilization systems on the growth and development of *Rosa hybrida* 'Radtko' and *Hibiscus rosa-sinensis* 'Evangeline' in pot-in-pot (PIP) container production were studied. The 6-month study conducted at Stephen F. Austin State University Arboretum in Nacogdoches, TX started Apr. 2010 and ended October 2010. Treatments were arranged as 3 fertilizer types (Stagreen 12-6-6, Green Edge 6-3-2, and Turkey Blood Cotton Gin Compost 3-1-2) x 5 nitrogen rates in grams (0, 0.39, 0.78, 1.56, and 3.12) factorial with 8 replicates per treatment for a total of 120 plants of each plant type. The fertilizers were top dressed in each pot monthly for the knock-out roses and bimonthly for the tropical hibiscus. Monthly measurements were taken to determine average growth of each plant, and an average growth index (AGI) was calculated with the following formula: $AGI = (h + [(1 + w)/2])/2$. A visual marketability rating was taken on all plants in June and October 2010. Plants were subjectively ranked from 1-9 with 1 = dead, 5 = minimum marketable, and 9 = superior marketable to determine which treatments can produce a marketable plant. The results from AGI data indicate, Stagreen 1.56 g N, Stagreen 3.12 g N, and Green Edge 3.12 g N treatments for the roses and hibiscus produced significantly larger plants than all other treatments. Rose 0.39, 0.78, 1.56, and 3.12 N rate treatments for the Green Edge and Stagreen fertilizers produced marketable plants and all 0 N rate treatments and compost treatments did not produce marketable plants. The results for the hibiscus indicate that all treatments produced marketable plants. Based on the results of this study, Green Edge 6-3-2 organic fertilizer at 3.12 g N rate can be used to produce comparable knock-out rose and hibiscus

plants when compared to Stagreen 12-6-6 inorganic fertilizer at the current nursery rate of 1.56 g N in PIP system. The results also indicate that compost can't be used as a fertilizer source in container production of knock-out roses and tropical hibiscus.

Effects of Organic Rooting Treatments on Spring and Late Summer Cuttings of *Vaccinium darrowii* 'Native Blue' Blueberry

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Vaccinium darrowii 'Native Blue' is a low growing compact evergreen shrub with foliage color from pink to green. This cultivar can reach 3 ft. at maturity, produce small semi-sweet fruit, and be propagated by seeds or cuttings. Today many organic rooting treatments are being utilized. Many reports claim honey and *Salix* solutions decrease rooting time. The objective of this experiment was to compare organic and inorganic rooting treatments to determine which treatment promotes root growth from tip cuttings for 'Native Blue' blueberries based on season. In April 2009 and July 2010, 576 'Native Blue' tip cuttings were taken from Mill Creek Blueberry Germplasm Plots in Nacogdoches County, Texas. Cuttings were treated by a 30 second dip in 1 of 12 rooting treatments. The treatments included untreated control, 2 boiled honey solutions (1 and 2 tbs. of honey: 473 ml of water), 8 *Salix* solutions (20 and 40 g *Salix* leaves: 0.95 L water boiled or puréed; 20 and 40 g *Salix* stems: 0.95 L of water boiled or puréed), and Hormodin^{®2} (IBA 0.3%). Treatments were arranged in a randomized complete block design. Cuttings were stuck in 1:1 pine bark/perlite substrate. The trays were placed in a mist chamber. Cuttings were visually checked at 14, 21, 28, 35, 42, 49, 56, and 84 days after treatment (DAT) to determine differences in root development and rooting time. At 14 to 49 DAT, 16 of 48 cuttings were checked. At 56 and 84 DAT, 48 cuttings were checked. The data was analyzed by Repeated Measures ANOVA with a minimum significance level of 0.05%. For April 2009, *Salix* Solution of 40 g of boiled stems was superior to all treatments in increasing rooting percentages at 35 and 42 DAT. For July 2010, rooting percentage for *Salix* Solution of 40 g of stems and Hormodin^{®2} were significantly greater than all treatments in 21-56 DAT. The data indicated *Salix* Solution of 40 g of boiled stems produced comparable amounts of rooted cuttings compared to Hormodin^{®2}. When comparing by season, late summer cuttings rooted faster than spring; however, at 84 DAT spring cuttings had higher rooting percentages.

Slippery When Wet: Monitoring Insect Populations at the Nursery

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The strawberry rootworm (*Paria fragariae* Wilcox), or SRW, is a major pest for azalea growers in the Southeast. Enhanced IPM practices, including monitoring, can make SRW control more efficient, with money savings for pest control budgets. The traditional monitoring method for SRW is manual sweep netting. It was our hypothesis that a trap station designed for the nursery would increase yields for our SRW monitoring efforts, making this IPM practice less labor-intensive. In addition, we believed the incorporation of a solar light would further entice the nocturnal-feeding SRW to our trap stations. Three light and three non-light traps stations were set up at each of three nurseries, with sticky cards changed out bi-weekly. Sweep samples were taken from two plants in proximity to each of these trap stations at the same time for comparison with trap stations. Using Tukey's HSD test, we found that light traps collected significantly more ($P = 0.0056$) SRW than non-light traps or sweeps, while non-light traps and sweeps were not significantly different. In addition, significantly more ($P = 0.0078$) total insects were collected from our light trap stations, suggesting that they may prove useful for monitoring populations of other pest insect species. Establishment of an alternate monitoring method like our trap station may encourage growers to integrate more IPM practices at their nurseries, thus saving them money on costly chemical control applications, reducing the potential for development of resistance in pest insect populations, and keeping potentially toxic substances out of the environment.

Poinsettia Crop Production as a Multi-course Teaching Tool

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Experiential learning in plant and soil science courses provides students with applied knowledge and skills beyond those gained in traditional classroom settings. This educational concept was applied in a cooperative effort between two courses; Soil Analysis and Floriculture, using poinsettia crop production as a shared laboratory tool. The learning outcomes of each course were met while enhancing the overall learning of students in both classes.

Evaluating the Effects of Nitrogen Fertilization Rates on Growth and Gas Exchange in Young Pecan Seedlings

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Nitrogen (N) is important for developing healthy, productive pecan (*Carya illinoensis* K. Koch) trees. However, current applications of fertilizer generally follow a standard practice, without consideration of spatial, temporal, and climatic variability, often resulting in lost income and negative environmental impacts. To help improve current N management practices during tree establishment, it is important to know when to apply and how

much to apply. The aim of the present project was to evaluate above- and below-ground tree performance by measuring tree diameter growth rates, leaf photosynthesis, and root production following N application at five rates. Stem and leader diameters were measured three times, while gas-exchange was measured every 3–4 weeks using an infrared gas analyzer. Initial results have shown that N rate did not have a significant effect on diameter growth, photosynthesis, and it only had a significant effect on water use efficiency immediately after N application. This indicates that N application could be reduced; however, more data needs to be evaluated to support this conclusion.

Effects of Variable Irrigation Regimes on Containerized Olives

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Olive oil production in Texas is a fairly new and expanding industry. However, research has yet to be conducted that investigates irrigation response of olive trees grown for olive oil production in Texas. The purpose of this research was to investigate the physiological response of four containerized, greenhouse-grown olive (*Olea europaea* L.) varieties ('Abequina', 'Arbosana', 'Mission', and 'Koroneiki') to three differing irrigation regimes. A 2010 greenhouse study was conducted at Texas Tech University measuring soil moisture, mid-day stomatal conductance, and leaf water potential of plants exposed to three irrigation regimes [plants were irrigated every day (high irrigation), every other day (medium irrigation), and every fourth day (low irrigation)] over two separate 16-d experiments (during July and August). Data were collected prior to irrigation every fourth day. Results indicate high and medium irrigation treatments showed little physiological differences. However, low irrigation trees had lower conductance and water potential values when compared to other irrigation treatments. Results indicate irrigation frequency could be a management tool for olive oil production without negative plant physiological response. Oil production and quality of oil are additional factors that need to be considered prior to implementing any irrigation regime. However, this research suggests irrigation reduction during olive production could possibly save olive growers monetary and natural resources as they reduce the amount of irrigation water applied.

Fruit Quality Characteristics of Selected Hybrid Bunch Grape Cultivars

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A study designed to evaluate the various fruit quality characteristics and overall performance of selected Pierce's disease (PD) resistant hybrid bunch grape cultivars in Alabama's environment was initiated in 2009 at the Chilton Research and Extension Cen-

ter (REC), Clanton, AL. Mature vines from PD tolerant hybrid grape cultivars 'Black Spanish', 'Conquistador', 'Daytona', 'Foxye Lottie', 'Orlando Seedless', 'Stover', and 'Suwannee' were compared. According to the 2009–10 season results, 'Black Spanish' had the greatest mean cluster weight of 143 g, while 'Stover' had the smallest cluster of 60 g on average. 'Foxye Lottie' and 'Suwannee' had the greatest berry size of 3.3 and 3.2 g, respectively, while 'Orlando Seedless' had produced the smallest berries of 1.1 g on average. Based on cultivar soluble solids content, 'Orlando Seedless' was the sweetest hybrid bunch grape cultivar across both seasons with a brix of 20.8%, while 'Daytona' had the lowest brix readings of 8.9%.

Antioxidant Properties of Selected Rabbiteye Blueberry as Affected by Cultivar and Environment

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Four-year-old, commercially established rabbiteye blueberry cultivars ('Baldwin', 'Brightwell', 'Climax', 'Premier', and 'Tifblue') of two geographically opposing locations, North Alabama Horticulture Experiment Station, Cullman, Cullman County, and Gulf Coast Region, Wiregrass Research and Extension Center, Headland, Henry County, AL, were analyzed and compared with regard to antioxidant capacity and content. Antioxidant capacity was based on ferric reducing antioxidant power (FRAP) assay and was observed to be influenced by cultivar and location. However, neither cultivar nor location influenced 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) (ABTS) or 2,2-diphenyl-1-picrylhydrazyl (DPPH) antioxidant capacity assays. Significant main effects of cultivar × location for vitamin C, total phenolic (TP) and total monomeric anthocyanin (TMA) content were observed. Results of this study indicate that it is critical to determine the antioxidant properties of diverse blueberry cultivars in multiple geographic locations in order to confidently identify their overall quality and health promotive value.

Yield and Fruit Quality Characteristics of Selected Muscadine Grape Cultivars

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The discovery of high levels of health-promoting antioxidant compounds in muscadine grapes has brought more attention to the crop, creating tremendous opportunities for commercial growth. Muscadine grape cultivars 'Black Beauty', 'Black Fry',

'Darlene', 'Early Fry', 'Ison' and 'Janet' were evaluated during the 2009–10 season at the E.V. Smith Research Center, Shorter, AL, with an aim to determine their yield and overall fruit quality in Alabama's environment. Fruit quality characteristics measured include vine yield, average berry size and soluble solids content. 'Janet' and 'Black Beauty' cultivars produced high yields of 47 and 46 kg/vine, respectively, and the largest berries of 13.8 g on average. 'Ison' muscadine grape also produced high yield, and had the smallest berry size of 8 g on average. 'Darlene' and 'Black Fry' had the highest soluble solids content of 18.8%. Studies of this nature should continue to insure that the best performing muscadine cultivars are supplied to the industry

The Efficacy of Flower Bud Removal Techniques for Enhancing Growth of Young Blueberry Cultivars

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In this 2-year study, flower bud removal techniques were tested on young rabbiteye blueberry (*Vaccinium ashei* Reade) plants to determine effects on flower bud mortality and growth parameters. The treatments consisted of no flower bud removal (control), hand stripping, and hydrogen cyanamide applied at 0.75% and 1.5%. Treatments were applied to three different cultivars exhibiting different stages of flower bud development. The cultivars, listed from most advanced to least advanced flower bud development were 'Climax', 'Brightwell', and 'Tifblue', respectively. Both hydrogen cyanamide treatments resulted in higher bud mortality than the control, and the 1.5% treatment was as effective as hand stripping in year 1 (2009). Except for 'Brightwell' in 2009, leaf area was not affected by treatments. The growth index was not affected by the bud removal treatments in either year of the study. The 1.5% hydrogen cyanamide treatment appears to be an effective method of flower bud removal, and, as a labor saving practice, could be used as an alternative to hand stripping. However, this study indicates that flower bud removal may not result in increased vegetative growth for field-grown rabbiteye blueberry plants.

Evaluation of Rootstocks for 'Owari' Satsuma Production in South Alabama

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The objective of this research was to evaluate the performance of satsuma mandarin rootstocks in South Alabama based on growth and yield parameters. Six different rootstocks were used in this study: 'Flying Dragon' *Poncirus trifoliata*, 'Rubidoux' *P.*

trifoliata, ‘C-35’ citrange, ‘Swingle’ citrumelo, ‘Owari’ satsuma mandarin seedlings, and ‘Owari’ rooted cuttings. Trees were planted in a randomized complete-block design in 2003. All rootstocks were budded with ‘Owari’ satsuma mandarin with the exception of rooted cuttings. Yields were collected from 2005 until 2010. Data were analyzed using one-way ANOVA test, and means were separated using Duncan’s multiple range test. ‘C-35’, ‘Swingle’, ‘Rubidoux’, and ‘Owari’ rooted cuttings had a larger average canopy volume when compared to ‘Flying Dragon’ and ‘Owari’ seedlings. ‘C-35’ had the highest average 5-year total yield (508.5 lb_a). ‘Swingle’ (349.9 lb_b), ‘Rubidoux’ (263.9 lb_b), and ‘Owari’ rooted cuttings (208.6 lb_{bc}) had similar yields, whereas ‘Flying Dragon’ (92.9 lb_c) and ‘Owari’ seedlings (68.1 lb_c) had the lowest yields. Yield per centimeter of trunk cross-sectional area (lb/cm) was similar for ‘C-35’ (54.1_a), ‘Swingle’ (42.5_{ab}), and ‘Rubidoux’ (38.3_{abc}), and was reduced in ‘Owari’ cuttings (26.7_{bcd}), ‘Flying Dragon’ (19.8_{cd}) and ‘Owari’ seedlings (14.2_d). All rootstocks were statistically similar for yield efficiency (lb/m³ of canopy volume), with the exception of ‘Owari’ seedlings. ‘C-35’ is the overall best performer over the length of the experiment.

Postharvest Storage Life of ‘AU Golden Dragon’ Kiwifruit (*Actinidia chinensis*)

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The objectives of this study were to determine the approximate postharvest storage life of ‘AU Golden Dragon’ kiwifruit (*Actinidia chinensis*) and whether fruit size affects postharvest storage life and fruit quality. Kiwifruit were harvested and sized on 16 Aug. 2010 from the Chilton Research and Extension Center, Clanton, AL. Three different marketable sizes (small, medium, and large) were used for this study. The fruit quality of 10 fruit per size category was assessed initially, and remaining fruit was placed in cold storage. Fruit quality of 10 fruit per size category was assessed every 14 d for the duration of the study. The study was terminated at 14 weeks due to fruit chilling injury. The fruit size did not affect texture, percent dry matter (% DM), internal color, titratable acidity (TA), and soluble solids:TA ratio (SS:TA). In weeks 12 and 14, SS content was higher in large fruit compared to small fruit. For the most part, internal fruit color and percent DM remained stable in cold storage. As expected, fruit firmness and TA decreased while soluble solids increased due to length of time in cold storage. In this 1-year study, the postharvest life of ‘AU Golden Dragon’ was approximately 14 weeks, which is comparable to the current industry standard.

Growing Blueberry Knowledge via Social Networks

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The All About Blueberries Community of Practice (CoP) was built to help guide blueberry producers in the southeastern region of the United States in methods to maximize productivity, decrease production costs, and increase the marketability of their crops. The All About Blueberries CoP is incorporating the best existing Cooperative Extension publications and developing new research-based extension recommendations related to blueberry production and consumption on its website (www.extension.org/blueberries). The website officially launched 31 Aug. 2010. Social networking sites such as Facebook, WordPress, and Twitter are being utilized to help draw traffic to the website. Information found on the website is posted on the social network pages with links to the information on the website. A broader audience is reached by using these social network sites and, thus, traffic to the website is increasing. The CoP is using Google Analytics to measure website activity. From 31 Aug. 2010 to 5 Feb. 2011, 11,317 pageviews were made. Facebook ranks 6 of 29, and Twitter ranks 16 of 29 in Entrance Sources used to view the website. All of these online tools are free to use and free to access. Using social networks to share knowledge is a great way to reach more people. According to Uday Saxena, “If utilized well, social media can lead to great success ... it is possible to conduct regular business online.”

Performance of Persimmon (*Diospyros kaki*) Cultivars in Southern Mississippi

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The oriental persimmon (*Diospyros kaki*) is native to China, where it has been cultivated for centuries. In its native China more than 2000 different persimmon cultivars exist. Persimmons are best suited in areas of moderate winters and relatively mild summers (USDA Hardiness Zones 7 to 10). It can tolerate temperatures of 0 °F when fully dormant. However, because of its low chilling requirement (less than 100 h), persimmons will break dormancy during early warm spells only to be damaged by spring frosts later. Both astringent and non-astringent persimmon cultivars were planted in 2006 at the USDA Thad Cochran Southern Horticultural Laboratory test plots in Stone County, MS. Plants were established in a randomized complete-block design with 5 replications. In 2007, tree height and a count of fruit produced were taken 25 Sept. 2007. Ten fruit from each tree were collected in September and measured for height, width, weight, volume, and soluble solids (°Brix). In 2008, a spring freeze occurred 29 Mar. after several days of warm weather, giving an opportunity to assess freeze tolerance. Several cultivars had broken dormancy and began budding. The low temperature in the field reached 27.3 °F. Three weeks later (15 Apr. 2007) another less severe freeze reached 31.3 °F. Freeze damage ratings (1 none or minimal damage, 5 badly damaged) and percent leaf coverage estimates were recorded.

‘Victoria Red’ Table Grape: A New Option for Southern Grape Producers

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‘Victoria Red’ was released cooperatively by the University of Arkansas, Texas A&M University, and Tarkington Vineyard in 2009. ‘Victoria Red’ is a result of a cross of Ark. 1123 × ‘Exotic’ made in 1971. The paternal parent is pure *Vitis vinifera* L. while the female parent is a derivation of largely French-American hybrids. The original plant was selected in 1974 from a seedling field at the University of Arkansas Fruit Research Station, Clarks-ville, AR, and tested as Ark. 1475. Initial testing of ‘Victoria Red’ was at that location, but more extensive evaluation was in Texas at Stephenville (Texas AgriLife Research and Extension Center) and Victoria (Tarkington Vineyard). The Victoria location is approximately 64 km from the Gulf of Mexico and has very high Pierce’s disease pressure. Berries of ‘Victoria Red’ are large, bright red, and attractive. Average berry weight in Arkansas was 4.6 g but was substantially larger (8.0 g) at Victoria. Berries are of high quality and *V. vinifera*-like in texture and crispness. Soluble solids content averaged 17.1% in Arkansas and 18.1% in Victoria. Clusters of ‘Victoria Red’ are attractive, large, and often long, loosely filled, and averaged 477 g in Victoria. Productivity of ‘Victoria Red’ in Arkansas was poor due to winter injury. Yield in Victoria averaged 9.1 kg/vine and in Stephenville ranged from 3.5 to 6.6 kg/vine depending on year and training system. In Victoria the average harvest date was 3 July and 8 July in Stephenville. A substantial limitation of ‘Victoria Red’ is winter hardiness. Temperatures of –15 to –11 °C in Arkansas damaged vines. Fruiting was consistent at Victoria. ‘Victoria Red’ is likely reliably hardy in the mid- to lower South, and should be planted in USDA hardiness zone 7b or warmer locations. The survival of ‘Victoria Red’ for over 20 years at Victoria indicates either tolerance or some degree of resistance to Pierce’s disease. A very limited number of cuttings or vines are available from James Kamas (j-kamas@tamu.edu).

Broad Mites, a Potential Pest in Blackberry Crops of the Southern United States

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New blackberry cultivars, specifically primocane-fruiting cultivars, have been developed that change the fruiting season

and possibly the cultural practices associated with growing blackberries. This change in seasonal fruit production and plant management warrants investigation into the pest species that previously might not have been as important. Broad mites, *Polyphagotarsonemus latus* (Banks), in particular have recently been found in blackberry crops of the southern United States. They have been associated with foliar damage to blackberries in consecutive years in Arkansas and North Carolina. The life cycle is very short, between 12 and 19 d from hatch to oviposition. Two broad mite infestation symptoms are downward curled leaves likely resulting in reduced photosynthesis and bud abortion. Genotype has been observed to be a factor in both population growth rate of the mite and plant response to the mite. Management can be achieved with general miticides, insecticidal oils and soaps, possibly predatory mites, as well as cultural management such as mowing for primocane crops, although this eliminates the possibility of a spring crop. Future research goals should consider identifying tolerant or resistant cultivars, and the mechanisms responsible for the tolerance or resistance; the extent of quantity or quality losses from mite damage; the most economical management practices; and the natural enemies and environmental ranges of broad mites.

Grafting Heirloom Tomatoes for Improved Crop Vigor, Yield, and Fruit Quality

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Grafting technology has been employed in vegetable production to improve plant resistance to soilborne pathogens, tolerance to abiotic stresses, crop vigor and yield, and fruit quality. Given the relatively high cost of grafted transplants, adoption of vegetable grafting in field production may be more rapid among organic growers than conventional growers. This is due to limited disease control measures and the premium price received for organic produce. The objective of this study was to assess the potential of grafting as an effective tool for organic heirloom tomato production. Two scions, ‘Brandywine’ and ‘Flamme’, were grafted onto two rootstocks, ‘Multifort’ (interspecific) and ‘Survivor’ (intraspecific). Non-grafted and self-grafted scions were used as controls. Results from the 2010 spring trial showed that grafting had a significant impact on crop vigor. ‘Brandywine’ produced significantly greater aboveground biomass and leaf area when grafted onto ‘Multifort’ compared to any of the other treatments. Leaf area was also significantly increased when ‘Flamme’ was grafted onto ‘Multifort’ rather than ‘Survivor’, further suggesting that rootstock–scion combinations may play an important role in crop vigor. Grafting reduced the yield of ‘Flamme’ at first harvest; however, in general no significant differences in yield among treatments were observed after the first harvest. Harsh weather in early spring delayed planting and the short growing season may have affected yields. A consumer taste test was conducted

using a hedonic scale to determine the influence of grafting on perceived sensory attributes of 'Brandywine' fruit. Fruit from 'Brandywine' grafted onto 'Survivor' scored significantly lower than the other treatments, indicating that rootstock selection may affect consumer sensory perception of fruit attributes. To optimize the use of grafting in heirloom tomato production, the effects of vigorous interspecific rootstock and rootstock–scion interactions on crop productivity deserve further research.

Plant Density and Deficit Irrigation Effects on Water Productivity of Watermelons

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The effects of deficit irrigation and plant population density on watermelon (*Citrullus lanatus*; cv. Tri-X 313) leaf water potential, gas exchange, yield, and water productivity were investigated. Replicated field plots with varying in-row plant spacing (0.46, 0.91, 1.4 and 1.8 m), were subjected to two irrigation regimes (100% and 75% replacement of crop evapotranspiration, *ETc*). Midday leaf water potential (ψ_l) declined with deficit irrigation, but generally increased with plant population density especially in plants subjected to deficit irrigation (75% *ETc* replacement). Average leaf stomatal conductance and net assimilation rates followed a similar pattern as leaf water potential. Total canopy vegetative dry biomass was much higher in plants subjected to 100 *ETc* than those subjected to 75% *ETc* and declined with increasing plant density. Average marketable fruit yields increased with plant density at ~3.5% plant density. Fruit yields were also significantly higher in plants subjected to 100 *ETc* than those subjected to 75% *ETc*. Average number of fruits per plant declined with increasing plant density; however, average fruit size did not differ significantly among treatments. Water productivity (tons/acre-inch) increased significantly with plant density at about ~0.6% plant density, but did not differ between irrigation regimes. The data suggest that increased planting density can increase net returns with the same amount of irrigation input.

Transplanted Watermelon Plants by Chisel, Strip-tillage, and Bedding Methods Result in Similar Yield and Quality

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Watermelon plants grown in semi-arid, subtropical southern Texas (lat. 26°N) are subject to wind and high solar loads. In an effort to provide an environment that would reduce wind-related sand blasting, early transplant desiccation, and vine damage and reduce soil temperatures, watermelon seedlings were transplanted into chisel- and strip-tilled high surface residue (14 t/ha) Raymondville silt-loam soil and compared to the standard method of plowing and bedding. A diploid ('Jamboree') and

a triploid ('Tri-X 313') watermelon were used as sub-plots in a transplant establishment (main-plots) experiment with four replications. Maintaining high soil residue reduced average daily soil temperatures in the chisel and strip-tilled establishment plots at 5-cm ($P = 0.03$), 10 ($P = 0.20$), and 30-cm ($P = 0.01$) depths compared to bedded melons. Daily maximum surface temperatures (unreplicated), measured by IR thermometry, were lowest in the bedded plots, suggesting that soil cooling by water loss might be the reason for the lower temperatures. However, seasonal moisture at 30 cm was influenced only by date and not by transplant method. Rainfall for the experimental period was unseasonably high (52% of ET). Plant establishment method did not influence average fruit weight, marketable fruit weight, or marketable fruit number, but planting into high residue soil increased both marketable yield (%) and marketable fruit (%) with 'Jamboree' showing the greatest response to a high residue environment. Fruit quality attributes (objective color and firmness) were not affected by plant establishment method, but 'Tri-X 313' soluble solids (%) were higher than those of 'Jamboree' (12.0% vs. 11.5%). Cultivars did differ in fruit weight, marketable fruit, and marketable yield (%), and marketable fruit number (%).

Onion Transplant Production System for Oklahoma

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Onions are a valuable specialty crop. Hoop houses were previously found useful for producing transplants as a means of overcoming problems associated with commercially available transplants, which include poor stands, high bolting incidence, low productivity and cultivar availability. Here we report on additional assessment of hoop house transplant production including productivity and seeding date effects on bulb size and bolting. A cultivar trial using cultivars Candy and 1015Y was seeded 2 Nov. 2004 and field transplanted 26 Feb. 2005. Only minor incidence of bolting was observed. Onion yield and size distribution did not differ between cultivars and 80% to 90% of bulbs had 3-inch diameter or greater. A planting date trial using the cultivars 1015Y and Candy was seeded 18 and 25 Oct. and 2 Nov. 2005. Field plantings made at two locations in early March resulted in no bolting. Production of bulbs with 3–4 inch diameter ranged from 35% to 75% and did not differ between cultivars. Candy produced more bulbs >4 inch diameter at both sites. A second cultivar trial using 12 cultivars was seeded 4 Nov. 2007 and field transplanted 25 Mar. 2008. Bolting was observed in 10 cultivars. Only four cultivars exhibited >5% bolting: Cimarron (9%), Rumba (10%), Renegade (18%), and Sequoia (9%). Among a group of eight top-yielding cultivars ('Sequoia', 'Renegade', 'Denali', 'Cimarron', 'Chief', 'Desperado', '1015Y', and 'White Wing') no marketable yield

(bulbs >3 inches diameter) differences were detected. These studies show that hoop house onion transplant production in southeastern Oklahoma can result in plants with a low bolting tendency and that the system is compatible with several cultivars for achieving marketable size onion bulbs.

High Tunnel Design: Moving a Semi-permanent Structure

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Season-extension is becoming an important tool for specialty crop growers across the United States. High tunnel construction in the South is increasingly common, especially with the 2010 advent of a NRCS cost-share program. In the initial year of the 3-year pilot program in Mississippi, 79 applications were considered. This increased interest among growers has resulted in an expansion of high tunnel research and outreach programs across the state. Growers are interested in moving a high tunnel for several reasons including improved orientation for optimal aeration or sunlight exposure, reduced buildup of weed banks and soilborne pathogens, decreased soil compaction, and cover crop planting and crop rotation (especially for organic producers). In response to repeated questions from growers concerning construction of high tunnels designed for future relocation; a team, including a horticulturist and an engineer, designed a demonstration process for moving a high tunnel. The goals of the process were to: 1) reposition the high tunnel using a "minimal" amount of tooling and equipment, 2) cause no damage to the structure, and 3) maintain the integrity of the structure ("squareness"). The high tunnel moved in this demonstration is 28 ft × 96 ft. The design of the high tunnel included base rails into which the bows were connected. The end of the base rails are turned up slightly to reduce drag when moving. Three temporary ground-level aluminum braces were attached perpendicular to the base rails to provide additional support and decrease spreading of the bows. The high tunnel was moved with a dual-block apparatus. Two 6-inch sheave blocks were positioned and secured 120 ft from the original high tunnel position, each in line with the base rails. Braided 7/8-inch nylon rope was anchored to each base rail, passed through the blocks and secured to a tractor draw bar. This 55-hp 4WD tractor traveled opposite of the high tunnel path, passing under the tunnel as it successfully moved into its new position.

Establishing a Maturity Index for Lotus (*Nelumbo* spp.)

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Nelumbo nucifera 'E2' is an underutilized but popular, edible, and ornamental aquatic plant that is also valued for its medicinal properties. Presently there are no established commercial guidelines for harvest maturity. In this study, nondestructive (chlorophyll measurements CCM-200) and destructive (total chlorophyll content, TC, dry weight, DW) determinations were compared for two types of leaves (long and short) as possible senescence indicators over four harvest dates in Sept.–Oct. 2010, at 2-week intervals. The purpose of this research was to evaluate these methods as potential predictors of maturity at harvest. Simple linear regression and correlation analysis were used to determine the relationship between nondestructive and destructive methods. CCM-200 values and TC content indicate degradation of chlorophyll over time for both types of leaves. Results from this study suggest the potential use of CCM-200 meter and TC content to predict maturity at harvest requires further evaluation.

Preharvest Antioxidant Content as a Determinant for Lotus (*Nelumbo* spp.) Maturity

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The purpose of this study was to investigate the influence of preharvest Vitamin C content as a predictor of maturity at harvest for lotus (*Nelumbo nucifera* 'E2'). Historically, harvest time for edible rhizomes of lotus is generally after leaves senesce. However, maturity-based harvest index is not well documented. In this study, vitamin C content in long standing and floating leaves and rhizomes were used for maturity determinations as possible senescence indicator over four harvest dates in Sept. through Oct. 2010 at 2-week intervals. Leaves contained more vitamin C than rhizomes. Vitamin C content in standing long leaves exhibited a quadratic, floating leaves a cubic, and rhizomes a linear relationship, whereas vitamin C content in rhizomes increased with leaf senescence. In rhizomes, a positive linear relationship between vitamin C content and harvest was observed. Results from this study suggest preharvest vitamin C content may be used as a harvest indicator. Further research is needed to determine optimum harvest time for rhizomes as vitamin C content failed to attain a maximal level.

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